Pacific Discovery

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IN THIS ISSUE: *J. Wyatt Durham*

Joel Hedgpeth • Don Bleitz • Oliver Kehrlein

Engineers Reply to "Gold, Men and Fish"

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Pre-Discovery:

Our roving department "Roads to Discovery" will, like a bit player, wander on stage now and then when it has a few lines; or, should we say, it will appear whenever the editor can collar someone just returned from a trip somewhere. When a curator is gone for six months—to Australia, for instance—he finds on return an appalling pile of homework upon his desk, not to mention the weeks, months, maybe years of labor he brings back with him in the shape of specimens and field notes. Anyhow, we did finally get some lineage out of one about a recent collecting expedition—a six months' trip, in fact, to the land of the world's strangest reptiles. Some other matters are less predictable. We are beginning to think there is a race on among certain authors, to see who gets his copy in last. So we'll not preview any titles.

There are, by the way, several exceedingly interesting stories in the making at this moment—events now happening—promised for near-future issues.

Discovering PD's Authors:

The author of "Sumatra's Minangkabaus and Bataks" was introduced in May-June *PD* with his note on fossil starfish. Dr. **J. Wyatt Durham,** Associate Professor of Paleontology in the University of California, is as much a scientist in his avocations as in strictly professional interests. A petroleum geologist in Java and Sumatra before W.W. II, he put a trained mind and camera to his inevitable interest in the native peoples of the areas to which he was sent.

The story of Ishi, "last stone age man in the United States," has been told before, popularly and anthropologically, and will doubtless be retold many times as it passes into the folklore of the West. Writing "The Haunted Canyon," **Joel Hedgpeth** was plainly gripped by mood of place and period which together conspired to produce this episode in history. Yet it is characteristic of our author-scientist that reflections on human motivation and the context of action appear between his lines. Scientist with a social conscience, he cannot rest on mere documentation; he must look behind and beyond the event.

It was planned at the outset that *PD* would encourage those who tell the story of science with cameras, by using the best of their work obtainable to illustrate its articles, and by featuring from time to time photography (for its own sake) of exceptional worth. **Don Bleitz's** "White Pelicans" set a standard for our new department "Photo Center" (which is looking for a better name) that will not be easy to maintain. This young man of Hollywood must have been weaned on hypo. "I manufacture photographic equipment part of the week," he wrote us; "I sell photo equipment part of the week, and on week-ends I go out and make photos of various wildlife and scenery, and specialize in birds. I have built a couple of special cameras for bird photography, and my present outfit will soon be operated by radio control. I have probably carried more camera equipment over hills and valleys, and through swamps, to make fewer pictures than anyone." His "fewer" includes 500 4x5 color transparencies of birds, and a much larger number of black and whites!

Oliver Kehrlein ("California's Frozen Water Supply"), writer, editor, long time member and a director of the Sierra Club, Chairman of the Glacier Studies Committee for the Sierra Club, California Chairman of the Glacier Committee for the Geophysical Union, is one of the not too-large number who know intimately the ice-girt roof of the *Range of Light*—to give the title of the newest book on the Sierra Nevada, of which he is one of the authors.

After publishing Joel Hedgpeth's "Gold, Men and Fish" (originally appearing in *The Land),* the editors braced themselves for the expected storm. The two letters under our title "Gold Men and Fishermen" are literally the only reply to Mr. Hedgpeth we have received. We are happy to present them. To be controversial is to be alive.

D. G. K.

SIRS:

I read with great interest the stirring articles by Leopold and Lowdermilk in your last issue. I assume their being published together was no accident but that rather you intended to emphasize the intimate relationship between the loss of soil fertility and the silting and pollution of rivers. The rivers gain what the soil loses—to the detriment of both.

Both articles are well written, timely, and to the point. Both leave the reader with a desire to act. Here are two desperately pressing problems of our times, so interrelated that the solution of one implies at least the partial solution of the other.

Since we probably will never give up cities as part of our civilized culture it would certainly seem that the responsibility for the solution to the problem can be equally divided between the farmer and the city dweller.

As I said the articles leave the reader with a desire to act but somewhat frustrated by not knowing just how to act (other than by favoring the Mundt Bill). How about another pair of companion articles to follow up Leopold and Lowdermilk?

1. "A Blueprint for Responsible American Agriculture." This should outline in words of one syllable the longest possible view of the direction our agriculture can and must take if it is to fulfill Lowdermilk's "Eleventh Commandment." It should be meaty enough for a farmer to get his teeth into it, and answer his question, "What can I, the individual custodian of the land, do?" And, since the plan may call for so profound a revolution that it cannot be achieved in a generation or two, it should also answer the same question for the farmer's children and grandchildren. Obviously the man who writes such an article must not only have an insight into the big picture of American agriculture but also into the day to day problems of a farmer making a living.

2. "The City Looks at Soil Conservation." This article should preferably be written by a conservation-minded city engineer. It should outline a sound technological method by which the tons and tons of soil fertility in the form of human waste from a big city can be economically salvaged and returned to the land—and kept out of the rivers. Since this may mean a drastic change in our methods of handling sewage, we need here a practical man not bound by traditional methods. Surely there must be such a city engineer somewhere.

Since you have done such an admirable job in getting the fundamental problem stated, I feel you owe your readers some equally clear thinking on the solution of the problem. I hope you will try it.

CHARLES C. BRADLEY

Madison, Wisconsin.

SIRS:

. . . One point has puzzled me, and that is, how do you distinguish between the "Big Tree" described by Woodbridge Metcalf on page 4 and the "Redwood" in the "Save-the-Redwoods" advertisement on page 29 [*PD*, May–June]? It is my understanding that the two trees are both species of the genus *Sequoia*, that they look very much alike and are both huge. Mr. Metcalf refers to "Big Tree" in places and "Sequoia" in places. Does everything he says here apply to both the "Big Tree" and the "Redwoods"? Does the "Save-the-Redwoods League" work just for the Redwoods or all the Sequoias including the "Big Tree"?

HENRY S. HOWE

Brookwood Farm, Canton, Massachusetts.

Although the Save-the-Redwoods League, founded 30 years ago by Madison Grant, Henry Fairfield Osborn, and John C. Merriam, has fought chiefly to save from the ax the greatest stands of Coast redwood, it has worked actively for the preservation of Big Trees of the Sierra Nevada, and has lately taken up the cause of the newly discovered "Dawn Redwoods" of China which man threatens with speedy extinction. Professor Metcalf answers some of Mr. Howe's questions:

. . . All the references in my article ("Youthful Years of the Big Tree," *PD*, May–June 1948) . . . are to the Big Tree of the Sierra, *Sequoia gigantea*. The Save-the-Redwoods advertisement on page 29 of the same issue of course refers to the Coast redwood, *Sequoia sempervirens*.

Sequoia gigantea, recently called by some botanists *Sequoia dendron gigantum*, is native only in the Sierra in somewhat scattered distribution above 5,000 feet elevation from Tulare County to Eldorado County. The best stands are in the vicinity of Sequoia-Kings Canyon National Park and adjacent areas of Redwood Mountain. The most common designation for this species is Big Tree, but it is also known locally in the Sierra as redwood and sometimes as Sierra redwood.

Sequoia sempervirens is found from central Monterey County to slightly north of the Oregon line in heavy stands, usually at elevations below 1,500 feet and rarely more than 30 miles from the ocean. It reaches its best development in Mendocino, Humboldt, and Del Norte Counties.

For additional references on the two Sequoias, I suggest your correspondent look at one of the following: Sudworth, *Forest Trees of the Pacific Slope;* Sargent, *Manual of Trees of North America;* Bowers, *Cone-bearing Trees of the Pacific Coast;* Gibson, *American Forest Trees;* Collingwood, *Knowing Your Trees;* Jepson, *Trees of California* and *Silva of California;* Shirley, *The Redwoods of Coast and Sierra.*

WOODBRIDGE METCALF
Extension Forester

University of California, Berkeley.

Professor Metcalf also furnished a more complete list of Sequoia references, which PD *will gladly mail upon request.*—EDITORS.

EDITORIAL

REPRESENTING the Academy and *Pacific Discovery*, your editor was privileged to be among guests of the Save-the-Redwoods League at a dinner August 29 in San Francisco, celebrating the dedication of the Madison Grant Memorial Forest and Elk Refuge in the Prairie Creek Redwoods State Park, California.

Among the distinguished gentlemen at the speakers' table was one whose presence had special and multiple significance. President of the New York Zoological Society, Fairfield Osborn represented an institution which had generously shared in the work and the cost of preserving one of California's—America's—finest remaining stands of the Redwood. His father, Henry Fairfield Osborn, co-founder with Madison Grant and John C. Merriam of the Save-the-Redwoods League thirty years ago, President of the New York Zoological Society 1909 to 1925, was one of the great first leaders of the Conservation movement in America. Theodore Roosevelt, William T. Hornaday, Gifford Pinchot—such were the men who warned the American people they were destroying beyond replacement their heritage of wildlife, of forests, of supposedly unlimited natural resources.

Out of the dedicated labors of these men came societies, leagues, foundations, pledged to the preservation and, wherever possible, the renewal of what we had left after generations of ruthless exploitation, of utter disregard for the future.

The optimistic, the complacent, the wishful-thinking may believe the tide of destruction has been checked. For some few species of wildlife, it has—when it was not already too late. For our forests, it has not; we still cut and burn faster than forests grow. But there is a threat, not new—it is old as civilization—but newly seen for what it is: a huger cloud over civilization, over human survival, than the atomic bomb. It is man's threat to the land itself—the land which now feeds, clothes, houses more than two billion human beings, on a scale of sufficiency fast diminishing—but those who see it are a handful.

Few Americans have seen this cloud; those who write headlines haven't. Ancient civilizations of North Africa and the Near East did not see it; it wiped them out, grubbing blindly in the dust of once-fertile earth. China has lived under it for centuries, if you call it living to die by the yearly millions of hunger and flood. So in India. But—not here!

Not here? Are we a specially privileged branch of humankind—or are we fellow-colonists of one planet with the rest of the two billion? Are we taking better care of our plot of Earth than any other nation? Hardly, when we are destroying productive land at a faster rate than any other people has, past or present. Not yet, America. But are we looking ahead?

There are men who see this threat clearly, presently; behind their vision is knowledge. They are telling us, so we can have no excuse in ignorance of the law of survival. There is a new generation of conservationists, with a more urgent, more terrible message than their fathers'. They are telling us how we destroy our land, and what we must do if we want our own children to live without hunger. Walter C. Lowdermilk is telling us ("The Eleventh Commandment," *PD*, May-June 1948); he was Assistant Chief of the U. S. Soil Conservation Service. William Vogt is telling us *(The Road to Survival*, just published); he is chief of the Conservation Section of the Pan-American Union. Fairfield Osborn is telling us *(Our Plundered Planet*, reviewed in this issue). These men deal with facts.

In forthright words President Osborn briefly spoke his message to this gathering of conservation-minded men and women in San Francisco. Many must have wished, with this editor, that a microphone were delivering his voice to a national network. But could he have competed with swing bands, comedians?

This is part of the "Report of the President" in the New York Zoological Society's *Annual Report* for the year 1947:

> . . . Today our efforts are directed not only towards the protection of animal life but also towards the conservation and proper use of the other related and interdependent resources of nature, namely, forests and other plant life, fertile soils and water sources. In effect we have come to realize that the problem, an increasingly urgent one, is that of conserving the *living environment* as a whole. Robbed of its natural environment animal life disappears; robbed of sufficient forest cover water sources diminish; robbed of adequate vegetative cover fertile soils are blown or washed away. In the center of the circle stands man, collectively our civilization, still the destroyer but potentially the conserver. From every point of view the cause embodied in the word *Conservation* must be supported with increasing vigor.

Pacific Discovery would fail those who by subscription and by membership in this Academy support it if it did not "with increasing vigor" press the cause of Conservation. So doing, it will not grind axes: it will cut straight into questions, often controversial questions, and let the chips fly. Only thus can heart and root be laid bare. Our pages are open.

D. G. K.

Sumatra's Minangkabaus a

J. WYATT DURHAM

TRAVELING THROUGH CENTRAL SUMATRA from the region of Lake Toba south to Fort de Kock, one is immediately struck by the beauty and unique design of many of the native dwellings, particularly those not affected by the "modernizing" influence of the last twenty-five years. In the north, grouped around Lake Toba are the characteristic houses of the Bataks and the various subgroups of this tribe, while the colorful swaybacked houses of the Minangkabaus center about Fort de Kock. These two peoples are found throughout the highlands of all Central Sumatra to the exclusion of other groups, with the characteristic culture of each being most strongly evident in the heart of its own area and becoming less evident in the intermediate regions. On the periphery of the Minangkabau-Batak territory, throughout the lowlands of the east coast, the inhabitants are mostly Malays, a seafaring group of somewhat mixed origin and no distinctive culture.

The striking houses and characteristic dress of each are the most apparent outward evidence of major differences between the two tribes; but more fundamental, their social organizations are at opposite extremes: the Bataks are patriarchal, the Minangkabaus matriarchal.

According to Edwin M. Loeb, in his book entitled *Sumatra,* the first mention of the Bataks is by Herodotus who called them *Padaioi,* or cannibals. These people are, in fact, still famous for their cannibalism, which they are known to have practiced locally until well into the twentieth century. When I was living in western Java (1937) and received notice that I was being transferred to Sumatra, I had in my employ an excellent Sundanese houseboy named Saleh whom I wished to take with me to Sumatra. When Saleh was asked if he would go to Sumatra with the family (all expenses paid and a good salary), he thought it over for a day or two and after consulting his

North Toba Batak granary at Kabandjae. (Photographs by the author)

friends came out with this statement, "Saleh tida maoe pigi negri Sumatra, ada orang makan orang disana" (Saleh doesn't want to go to Sumatra, they have cannibals there). We tried to assure him that cannibalism had not been practiced there for a number of years, but to no avail.

Until after the beginning of the nineteenth century all the Bataks were pagans, although they had been influenced early in their history by Hindu culture and later to a slight extent by the spreading waves of Mohammedanism. The first authentic accounts of the Bataks, near the close of the eighteenth century, astonished the civilized world with the paradox of a well developed culture and a system of writing—among a cannibalistic people. Much of this culture was derived from the original Hindu influence. Although Sumatra was known to the Hindus in the first century A.D., the earliest known evidence of their penetration into the sphere of the Bataks is in the region of Padang Lawas, in the territory of the Mandaling Bataks where there are remains of several extensive temples and carvings, the earliest of which appear to date from the eighth or ninth centuries. The period of greatest Hindu influence appears to have been from the eighth to the beginning of the fourteenth

s and Bataks

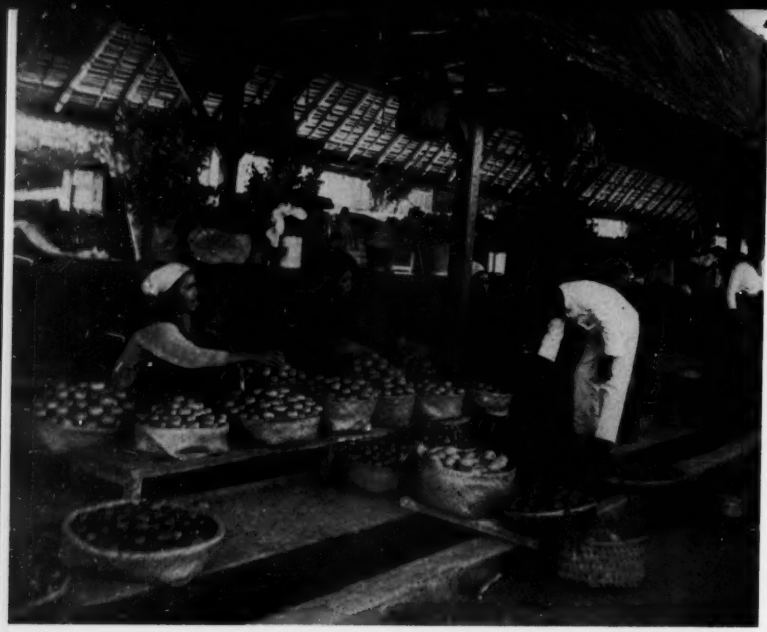
century when Mohammedanism began to spread through the island. According to Loeb, it appears that the Bataks owe much of their "magic," the introduction of wet rice culture, their peculiar style of dwellings, the game of chess, their vocabulary and system of writing, and much of their religion to Hindu civilization.

With the spread of Mohammedanism to the island, the Bataks were isolated from further contact with higher civilization and it was not until the first part of the nineteenth century that the southern Bataks were converted to Islam. At this time, during the "Padri" wars, a group of fanatic Mohammedan Minangkabaus overran and conquered the territory of the Mandaling Bataks and converted this branch of the tribe to Islam. When one of the Mandaling rajas or native princes was asked what had happened to the original Mandalings at the time of this war, he replied, "They were all killed or driven away, even the women and children." This seems rather unlikely for even though this "Padri" was much worse than any previous wars the Bataks had known, the present inhabitants of the region call themselves Mandalings, and maintain most of their customs and traits. The notable exception to this is in their dwellings, which over much of their territory retain little to mark them as of either Batak or Minangkabau origin, the area of Padang Lawas particularly being mostly "modernized" in appearance. Most of the members of the other branches of the Bataks are still pagans, but a goodly number in the vicinity of Lake Toba have become Christianized during the last hundred years.

Loeb indicates that probably the Bataks are rather pure representatives of a migratory group of Asiatics, a straight-haired yellow race who were the protoype of the modern Malaysians, and who probably arrived on the island around 2000 B.C. or slightly later. The Minangkabaus are also of this stock, and by an admixture of Hindu, Chinese, and Arabic blood are assumed to have given rise to the modern coastal Malays. Very early in their history, however, the Minangkabaus and Bataks split from their parent stock and began to take on their distinctive traits.

The Bataks are marked by a number of features, among the most prominent of which are: their long continued cannibalism, their patriarchal social organization, their distinctive dwellings, their filth (except the Mohammedanized members), and the liking of the men for chess. With regard to cannibalism, the cause of it is unknown, for its occurrence here is isolated; the nearest recurrence is in far distant New Guinea. It has been suggested that it might have been derived from the custom of head hunting—certainly it is not related to the advent of Hinduism, some sects of which are known to have been addicted to it, for it is recorded before the date of Hindu influence. In later recorded history at least, cannibalism was an official practice—a severe form of capital punishment, and was not common. It was used, almost always ceremonially, in certain cases of adultery, against traitors, spies and deserters, and against enemies who were caught alive outside the village and who had used their weapons against the people of the village.

In combination with the patriarchal social organization, both sexes have great freedom and mingle freely before marriage; after marriage, the woman is greatly restricted in her freedom. Al-



though theoretically the woman is the absolute property of her husband (or father), in actual practice she is rather well treated. The entire population is responsible for her protection, while wounding, shameless conduct toward her, and insult are heavily punished. Moreover, in times of war the women and children were always spared.

Even today most of the Batak villages (except in the Mohammedanized area) show much evidence of their past history. Almost all of the dwellings are gathered together in villages for protection against other villages—a relic of the days when wars between villages were common. All except those of most recent origin have the village surrounded by a thick hedge of extremely thorny and tough bamboo; often one may find also an earthen wall and sometimes a ditch around the outside. Usually there is but one narrow entrance through the hedge, but of recent years this usage has become lax and in some cases the hedges are breaking down through lack of care. The houses are all built on stilts, being raised four to six feet above the ground. Usually they are made of wood with roof of sugar palm fiber, but a few houses of modern construction have roofs of galvanized iron (a symbol of the wide ranging, persuasive German salesmen in the 'twenties). In the Mandaling Batak areas, most of the better houses have these galvanized iron roofs. In the typical Batak house the roof slopes inward towards the center, the upper ends of the roof extending outward over the front and back of the house. The tips of the ends are often decorated with the horns of the common carabao or water buffalo. The sides and ends of the houses of the rajas (or nobles) and the well-to-do families are usually ornately carved and painted in blues, blacks, reds, and occasionally yellows. Besides the family houses, often occupied by several families, there are usually council houses, young men's houses and in some areas young women's houses, rice granaries, and occasionally other buildings within the village. The council houses and the young men's houses are often extremely ornate. Usually the villages are very dirty, notably so among the Christianized Bataks. Pigs roam freely through the villages of the non-Mohammedan Bataks, and chickens roost in the houses. The lack of chimneys or flues keeps the houses full of smoke and soot, particularly while their occupants are cooking and eating.

The Karo Bataks formerly wore all blue clothing (dark red during war) and the Toba Bataks

ABOVE: *Batak fruit and vegetable market at Kabandjae. A Malay chauffeur examines the produce.*

MIDDLE: *Mandaling Batak rice paddy near Binanga (Padang Lawas); "country house" under the palm trees.*

BELOW: *South Toba Batak house near Balige. This one has a galvanized iron roof, thanks to some enterprising German salesman of the 1920's.*

brown; but these color distinctions are breaking down under the impact of modern civilization because of the marketing of cheap foreign-made cotton goods. All the Bataks except the Mandalings eat both pork and dog meat, a custom which causes much friction between them and the Mohammedan population of the rest of the island. In consequence, when non-Mohammedan Bataks are employed along with members of other tribes, separate camps and eating quarters must be maintained, for Mohammedans can be defiled (according to them) by the mere dragging of a pig along the road or path in front of their camp. Such affairs often result in serious communal fights and labor troubles for the oil companies and other employers of large groups of natives. My family and I once spent a vacation in the Toba Batak area and took our coastal Malay (Mohammedan) cook with us. Although she had become accustomed to handling pork, she often returned in horror from the market place, fuming about the dogs and dog meat on sale there.

The Bataks are often highly intelligent, although in the main they lack the necessary energy to use their intellect gainfully. Possibly the most marked application of their sagacity is in playing chess. It is a great surprise to many foreigners to find that many of the dirty and sometimes ragged looking Batak men can play an extremely competent game of chess.

In contrast to the non-Mohammedan Bataks, the Mandaling Bataks, the Minangkabaus, and the coastal Malays are characterized by their comparative cleanliness for the Mohammedan creed requires that all "true believers" must bathe several times a day. In consequence they are usually personally clean and have clean clothing.

As noted previously, the Minangkabaus are supposed to have been derived from the same stock as the Bataks. It has been presumed that the matriarchal social organization was introduced sometime in the first or second millenium B.C., and that it has continued to develop and enlarge among the Minangkabaus proper. In actuality the patriarchal and matriarchal systems as they exist in Sumatra are a series of anomalies; for instance, among the Bataks the women own no property and are considered as property, yet they can neither be sold nor abused; while among the Minangkabaus, although the woman nominally owns all the inherited property, the actual title to the property is in the hands of the men of her family, and a woman

ABOVE: *North Toba Batak houses at Kabandjae. The perennial pig is a standard feature of the landscape.*
MIDDLE: *Small village between Kotanopan and Rao, of a character transitional between Mandaling Bataks and Minangkabaus.*
BELOW: *Modern Minangkabau "adat" or council house and its caretaker.*

does not even have the legal right to dispose of herself in marriage.

All the widespread territory of southern Sumatra which was once included in the old Empire of Malayu is often considered Minangkabau territory, but actually the typical Minangkabaus are largely restricted to the highlands. Most investigators believe that the coastal Malays were derived from the Minangkabaus by an admixture of various races, but there is one important fact which militates against that belief. That is, that although the Minangkabaus are matriarchal the coastal Malays are patriarchal. It is noteworthy, however, that the Minangkabaus were subjected to much more Hindu and Mohammedan influence than the Bataks. Several important Hindu kingdoms, and kingdoms tributary to Javanese Hindu kingdoms, held sway over the greater Minangkabau area up until about the seventeenth or eighteenth centuries. Mohammedanism was introduced into the lowlands at least in the sixteenth or seventeenth centuries, but prior to this time the Hindu culture and civilization had a much greater development than in the Batak areas. Some of the kingdoms which reigned during this interval were extremely rich and powerful and their influence spread even to the courts of China.

Today the Minangkabaus have more or less of a Mohammedan veneer imposed on their original matriarchal social organization which is contrary to the tenets of Islam. All descent is through the mother's side of the family and the husband spends but part of his time in his wife's home, and personally owes allegiance to his mother's family, and has to help support it. The wife ordinarily continues to live in her mother's home as do her children. Each house may contain several families, all allied by common descent from a single woman. Strangely enough, though, the house is ruled by the oldest brother of the oldest woman of the house, provided he be fit. Contrary to the custom among the Bataks, the Minangkabaus are very strict about the relations of the sexes before marriage. The first marriage usually takes place quite early, but divorces are easy and it is reputedly not uncommon for a woman to have changed mates four or five times before she reaches an age when American girls are just considering marriage seriously.

Originally the villages of the Minangkabaus were much like those of the Bataks in that they were closely knit, fortified units. Formerly the villages belonged to a single family division to which the name *kampueng* was applied, and from which the modern Malay word for village, *kampong*, is derived. The kampongs or villages consist of a group of family houses, rice granaries, a council and communal house, and since the advent of Islam, a mosque. In the mountainous highlands where at present the most characteristic Minangkabau villages are found, a family house may contain as many as seventy or more people descended from the same female ancestor. As among the Bataks, the houses are raised on piles. Usually the house is elongate where more often Batak houses are nearly square. Like the Batak house, the roof is saddlebacked and has projecting ends decorated with carabao horns. But, unlike those of the Bataks, the houses usually have several of these projecting and decorated ends, one after the other. In the older and more fanciful houses the roof is always of sugar palm fiber; many of the later houses, on the other hand, are roofed with galvanized iron as among the Mandaling Bataks. The council and communal houses are usually highly ornate and decorated, somewhat in the manner of the Bataks, but the family houses are usually not so decorated.

The territory of the Minangkabaus is bordered on the north by that of the Mandaling Bataks, and in this region the houses have a style all their own, showing some of the characteristics of those of the adjacent areas, although they are not as elaborate as either. In the coastal regions, the houses of the Malays show little effect of either Batak or Minangkabau influence, being strictly utilitarian. These Malayan houses are like the others in but one respect: they too are built upon stilts.

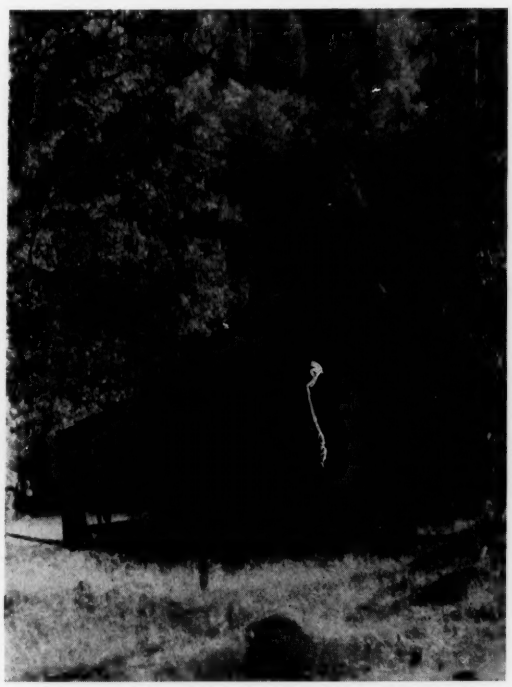
A tribe worth mentioning in conclusion, which lives in this same general region but in isolated jungle areas, is the Koeboe or Kubu. These people are apparently the remnant of wavy-haired Veddoid peoples who migrated into Sumatra before the ancestors of the other tribes appeared on the island. In their original state, at least, they are a very primitive group wandering around through the jungle, having no fixed home, living off the land. They have little or no social organization other than that of the immediate family which in itself is usually a transitory affair. At present, under the influence of Dutch rule and Mohammedanism, they are tending to settle down and assume a veneer of social organization, but there are still relatively large numbers of them roaming free in out-of-the-way parts of Sumatra's east coast.

THE HAUNTED CANYON

Joel Hedgpeth

THE CANYON OF DEER CREEK winds its way across the lava plateau of Tehama County, California, south of Lassen Peak, as a sheer walled trough, about thirty miles long. The stream that threads the bottom of this canyon starts as a brook among the sedges and grasses of a meadow in a parklike area between the aspens and lodgepole pines of the mountain country. The canyon itself begins as a shallow valley in the heavy forest at the lower end of the meadow. Soon there is an abrupt drop over which the stream is catapulted in a spectacular waterfall, and the valley becomes narrow and rocky. As the stream gradient increases, the walls of the canyon become higher. In the middle part of the canyon the walls are gaunt battlements nearly a thousand feet high.

Here and there a break in the canyon wall permits the entrance of a side stream. The tributary canyon is often flanked by pillars and pinnacles of brown and gray lava, encrusted with palette-like daubs of yellow, green, orange, and lavender lichens. The stream in the depths of the canyon tumbles over rubble and around huge boulders or slips through sluice-like channels of solid rock. In summer the water is low and warm, in winter it is a fury of cold white energy capable of throwing huge trees high up on benches or jamming them between rocks where they remain for decades. Smaller drift, summer and winter, finds its way southwestward with the stream to the Sacramento River.



Graham's cabin on Deer Creek, Tehama Co., Calif.

There are a few level patches in this almost inaccessible canyon, and on nearly every one there is an abandoned cabin, slowly falling apart. They look as if they had always been there, these forlorn ruins, and as if no one had ever lived in them. There is usually a table on trembling legs, or a bench built against the wall, and often there is a worn-out stove. Now and then a hunter or a fisherman spends a night in one of them, and some are used by the cattlemen, but always when a stranger comes upon them he finds no sign of life except the scurrying of a pack rat beneath the floor or the buzz of hornets around a nest under the roof. How the lumber, even the few boards and two-by-fours, was carried down the long rocky breaks in the sheer canyon wall, is something of a mystery—probably on mule or horseback, but that must have been a tedious business for both man and beast.

Graham's cabin, perhaps the oldest on the creek, was built sixty or seventy years ago, of square-hewn logs cut from a nearby pine grove. Old Man Graham seems to have made a sort of living trapping, and raised most of his food on a few roughly level acres on both sides of the stream near his cabin. The most accessible of the cabins is just inside the mouth of the canyon on a little flat of three or four acres. It is a little frame shanty, perhaps twelve feet square, and its walls are papered with newspapers bearing the date of January 1, 1911. The headlines tell the story of the death of Art Hoxie in an airplane crash. There are reports of interviews with other aviators of the day – Moissant and Johnson – who remembers

them now? The stock market was light on the last day of 1910: less than 100,000 shares changed hands. The latest book of Gibson Girl drawings had just been issued for the holiday trade. One wonders what the man who pasted these newspapers on the wall was thinking as he did so, and when he left the cabin. He had thought well enough of his place to plant a few roses, which still grow and bloom there after thirty-five years.

The inevitable gold diggings, universal in the California mountains, are marked by the indestructible piles of gravel on the benches around Polk Springs, deep in the canyon. But this is not gold country, this lava-bound region, and no one ever made his salt here. At Polk Springs there is also an abandoned hard rock mine, financed by stock sold in England. Perhaps the shares can still be found in English garrets or lumber rooms, hidden away in old trunks.

The sheer lava walls of the canyon are pocked with shallow caves like solidified bubbles, some of them high on the faces of the cliffs, where only hawks and owls have ever been, and others near the ground, with smoke-blackened walls that indicate they were once the dwelling places of men.

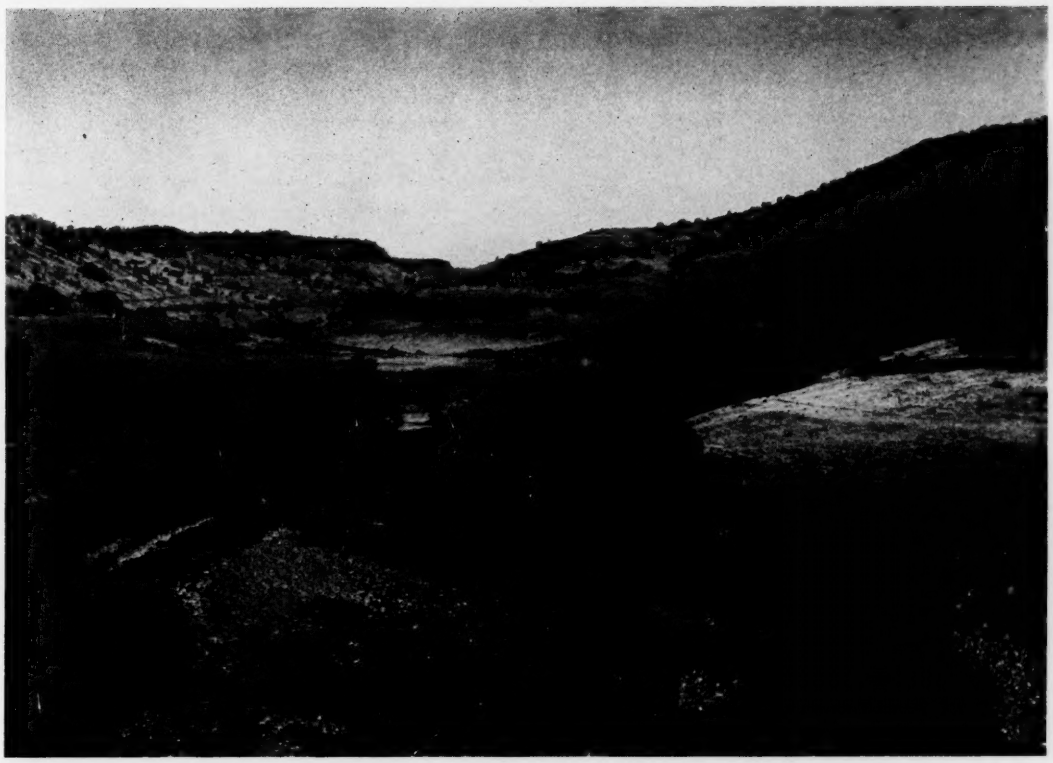
Alders, laurels, and willows grow along the stream. On the benches there are oaks and stunted pines. Here and there near the canyon rim is a grove of larger pines. At the lower end of the canyon, in the foothills outside the forest belt, the vegetation is chiefly willows and scrub laurel. At the edge of the lava plateau, where the level acres of the Central Valley are spread along the Sacramento River, the canyon comes to an abrupt end. The stream, freed of its narrow rock channel, meanders down to the river in a shallow gravel wash, bordered by large cottonwood trees and thickets of willows.

What white man first saw this canyon, we do not know. Perhaps it was John Bidwell, who named the streams in this country (without much originality), and suggested Deer Creek to Peter Lassen as a likely spot to settle. Lassen blazed his own trail across the mountains—it was a very bad route—from the headwaters of the Humboldt in Nevada, to bring settlers to his new city on the bank of Deer Creek. The last part of his trail followed the lava ridge north of the canyon down to the valley and his ranch, which was a couple of miles from the river. Lassen's settlement, ambitiously named Benton City, is remembered only by specialists in local history. The Lassen ranch eventually fell into the hands of Leland Stanford, who made a show place of it, with solid red brick barns and warehouses. During the prohibition era the wine grapes which were the particular pride and main resource of the ranch were pulled up; today the big barns are empty and the little town of Vina dozes beside its large, unused railroad station. At the highway, as it crosses Deer Creek, there is a stone monument beside a boulder-lined hole. This, an old cellar, is all that is certainly left of Benton City.

Long after the days of Peter Lassen and Benton City the original inhabitants of Deer Creek canyon lived in its untraveled recesses, and the manner of their going has made it haunted ground. Their last village, which they called Wowunupomotetna, the Hiding Place of the Bear, was only fifteen miles from the railroad. From the rimrock they could see the strange smoking beast on its way along the river. Yet for thirty years no white man knew of this village, and few believed that the once-feared Indians of the canyon still lived.

At the beginning of their end, the Yahi, as they called themselves, were much like any other northern Californian Indians. They were a hunting and food gathering people, whose acknowledged territory was the slice of lava crusted foothill country along the watersheds of Mill and Deer Creeks. The Yahi were the southernmost branch of a larger people, the Yana. All were foothill Indians, and the settlers called them Mill Creeks, without distinguishing the separate groups. The Yahi were, however, different from their neighbors and relatives in one important respect. They were used to fighting for their own, and the rocky canyons of their country with innumerable hiding places gave them a secure refuge from which to carry on their fight. But like their neighbors, they had no tribal organization, and they were without a strong leader.

How and when the Yahi first found themselves in difficulties with the settlers has not been recorded. Old Peter Lassen never had any trouble with them during his years on Deer Creek or while leading wagon trains through their country. But the Gold Rush brought a new variety of the human species to California, the rough character who regarded the Indian as a sort of vermin, in the same class as the wildcats and the rattlesnakes. There is a record that in 1851 one of these individuals, encountering an Indian whose looks displeased him, hung the redskin from a tree as a



Looking upstream from the mouth of Deer Creek Canyon. (Photograph by O. R. Smith)

lesson in deportment for the rest of his kind. Although this Indian was almost certainly not of their tribe, as the incident took place some distance south of Deer Creek, the news of it doubtless reached the Yahi.

The fundamental difficulty, of course, was the destruction of the game animals which were the Indian's meat supply. It was no rare thing for white hunters to kill several bears in a single day and leave the carcasses to rot after taking only the hides and tongues. What they did to the smaller animals which were even more important to the Indian economy has not been considered worthy of record. Cattle stealing by the Indians was an inevitable result of these inroads on their food supply, although it is certain that the Indians did not understand the white man's peculiar sense of property. Nor did the settlers trouble themselves about the fine points of Indian territories or different kinds of Indians. On their punitive expeditions into the hills they often killed the first band of Indians they met. If the chase was futile, they would go out of their way on the return trip to ambush some entirely innocent Indians.

The story of the fifteen years between that first hanging and the massacre of the Yahi is a tangled and bloody tale. There were long and futile chases through the mazes of the Deer Creek country, murders and abductions of whites by the Indians in reprisal, and counter-reprisals by the whites. The most determined expeditions were led by settlers from neighboring regions who had no immediate grievance, rather than by those nearest to the Yahi country.

During one hot September a troop of cavalry blundered over the hills without seeing an Indian. A Mrs. Dirsch was murdered, and the northern Yana were reduced to a remnant over the protests of their white employers, and the pockets of the dead were picked for their wages. The Lewis children were kidnapped. The boy was killed, and the girl, thankful, escaped by following Deer Creek downstream. These stories are still told in the country, often with bloody and obscene elaborations.

One version, told to me by one of the county's

noted spinners of tall tales, is evidently a blend of several incidents:

> I can tell you all about the damned Indians. They came down to the valley and stole some children. They killed the little boys and left them on a rock pile near here, and they went on with the girl. Somehow she got away when they left her behind with an old squaw. She remembered that her father told her to go downstream and she'd always get some place, so she came right down Deer Creek. She got down and she told folks about it, and a fellow—he's a dead shot—his name was Thomas, got up a posse and came right up to the meadows after them. They caught up with the Indians—he could see their camp smoke—and they surrounded them. Nobody shoot till I give the word, he said, and they killed every one of those Indians.

The murders which led to the disastrous end of the Yahi occurred on Concow Creek, far south of their range, but the Indians' reputation was against them. Mrs. Workman, her hired hand, and Miss Rosanna Smith, who had just arrived from England, were killed by Indians. Unprintable details have gathered around this killing, together with a confused story of several hundred gold sovereigns, which no one has ever found. To avenge these murders seventeen white men, most of them neighbors of the victims, set out to finish the Mill Creeks. Whether they trailed the Indians across the half dozen canyons between the site of the crime and the Yahi country, or assumed the direction of the trail, cannot be determined at this late date. At any rate, a trail was picked up just south of Deer Creek, and was followed across Deer Creek and into the smaller canyon of Mill Creek. On the eve of August 15, 1865, near a place now known as Black Rock, the avengers approached the Yahi camp.

Early in the morning the Indians were surrounded. Half the party worked down from the upstream side while the others blocked off escape downstream. When the alarm was given in the camp, a swift, brief massacre followed. The Indians, trapped in their narrow canyon, were poorly armed and unable to inflict any casualties on their attackers. When it was over, the creek was clogged with bodies and the sand bars between the rocks were sticky with fresh blood. After all the men had been killed, there was an argument. Should they let the women go, or kill them also? This was settled by turning them over to the neighbors from Concow Creek, who "dealt with them as they saw fit." A few years later a visitor to the place counted nearly forty-five skeletons.

There was one known survivor of this massacre, a boy with six-toed feet. The boy had caught the eye of one of the guides, who had an "odd taste about such things." A squaw was saved to take care of him, but it was a long climb out of the canyon and she had been wounded in the foot. When she refused to carry the child farther, she was shot. Five years later Hi Good was killed by his six-toed Indian boy in an argument over money.

The massacre of 1865 was the end of the Yahi as a hostile nation, but not of all the people. Some, perhaps, escaped from that disaster, others were somewhere else at the time. A few years after the massacre some Indians came to an outlying ranch, which happened to be Hi Good's place, to give themselves up and be taken to the reservation at Round Valley in Mendocino County. While the Indians waited around for some person of authority to arrive, one of the ranch hands amused himself by casting a rope over a tree limb. His idea was to hang a steelyard and weigh himself, but the Indians had had enough of the white man's ways—for them a rope over a tree limb had but one meaning. Without trying to recover the bows which they had brought with them in token of their surrender, they ran away. It was to be nearly forty years before one of these Indians, then the last survivor of his race, was to talk to a white man again.

There was one more massacre, in April, 1871. A band of about thirty Indians was trailed to a cave after a steer had been wounded by an arrow. All of these Indians were shot by the cowboys. One of them shot the children with his .38 calibre revolver because his .56 Sharps "tore them up so bad."

The surviving handful of the Yahi kept out of sight. Occasionally they would rob a cabin, and rarely someone caught a fleeting glimpse of an Indian disappearing into the thickets or rock piles. Only the recluses who lived in the lonely cabins along the stream and the cattlemen who worked in the country believed that there were still wild Indians living in the canyon. Old Man Graham, in his rough cabin of square-hewn logs, had more than his share of trouble with them, and set out poisoned flour for their benefit. The stories brought down to civilization by these hermits were laughed off by the townfolk as old timers' yarns.

But it was impossible to dismiss the incidents of 1908 as fiction. A surveying party, brushing out a line for a proposed water power development (which has never materialized), blundered into the middle of an Indian village hidden in a dense thicket of laurel trees.

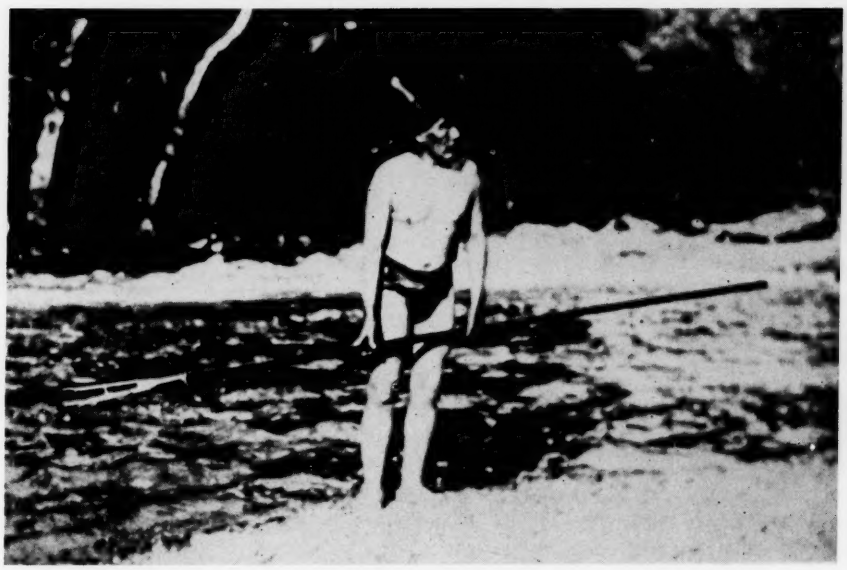
The night before, two of their party had returned from a stroll, soaking wet, with a story of having been threatened by a naked Indian with a huge spear. They had escaped by swimming across the stream. Their fellow surveyors had thought it a fine, realistic story, and complimented them on getting wet to substantiate it. Now here, in broad daylight, they had found the Indians. Two of them ran off into the rock pile at the base of the cliffs. One remained, a paralyzed old woman, who begged for water in almost forgotten Spanish.

The village itself was a cluster of three or four small huts of boughs, so well concealed that they were invisible from the cliff overlooking the laurel thicket in which they had been built. When the surveyors returned later in the day, the old woman was gone. They took away the effects the Indians had left behind in their flight as souvenirs, not realizing that the Indians needed them in order to survive.

No one ever saw these Indians again, nor does it seem that the band itself was reunited after this dispersal. Ishi, the brandisher of the spear, did not care to talk about this part of his life and his exact relationship to these people was never established. For the next few months the village was visited by all sorts of curious people, among them anthropologists from the University of California, whose professional interest brought them back to the scene several times. The Indians had abandoned the site altogether. It has since been burned out by a brush fire, and no trace of it remains.

In August, 1911, nearly three years after the discovery of this hidden village, a half starved Indian appeared in the yard of a slaughterhouse near Oroville, thirty-two miles south of Deer Creek. His hair was burned short in token of mourning and his only clothing was a cast off undershirt. He cowered in a corner while the dogs barked at him, and he was sick with fear. The sheriff was summoned, and the Indian was taken off to the county jail.

At a loss to know what to do with him, the sheriff placed him in the insane cell. The Indian knew no English, or any other language but his own, and he became a nine days wonder in the press. The University's anthropologists, hoping that this was one of the survivors of the Yahi village, sent Professor T. T. Waterman to try out



Ishi with salmon spear, May 1914. (From Univ. Calif. Publ. Amer. Arch. and Ethn., Vol. 13, No. 2, 1918, courtesy of the University of California Press)

Ishi demonstrating his bow and arrow. (From Univ. Calif. Publ. Amer. Arch. and Ethn., Vol. 13, No. 2, 1918, courtesy of the University of California Press)

a vocabulary on him. It was not the same dialect, but one word was familiar to the Indian: *su wini*—yellow pine. In this manner, Ishi, the last stone age man in the United States, came down from the hills.

Chaperoned by Dr. Waterman and an old survivor of the northern Yana tribe summoned to act as interpreter, Ishi left for San Francisco. First he wanted to hide from the train, which he believed to be some sort of evil demon. Once in San Francisco, he soon adjusted himself to civilization. The high walls of the tall buildings did not awe him in the least; after all, they were hardly as imposing as the cliffs of his homeland. But he never ceased to be amazed at the number of people in the city.

Street cars delighted him. He watched them for hours, marveling at their size, the noise of the gong, and the snorting of the air brakes. Automobiles impressed him less. Soon he learned to accept the works and doings of white men with apparent calm. When an airplane was pointed out to him, he was only mildly curious. It seemed quite natural to him that a white man should be up there. A water faucet was much more interesting and practical to Ishi.

He was a find for the anthropologists. All of his life had been lived by the primitive skills and crafts which had long since been forgotten by other California Indians. The language he spoke was virtually unspoiled. He was an excellent craftsman, especially at making bows and arrowheads. Dr. Saxton Pope, an ardent archery enthusiast, became his friend and personal physician, and learned much about the Indian ways of hunting with the bow and arrow from Ishi. His dialect proved too much for the interpreter, who condescendingly regarded him as a savage, but authorities on Indian languages came great distances to listen to him and record his stories.

The Board of Regents of the University of California formally appointed Ishi a museum helper, and he was given a room in the anthropology museum, which then adjoined the Medical School on Parnassus Heights in San Francisco. Here he made a wonderful collection of arrowheads, most of them from bottle glass. Bromo-Seltzer bottles were his favorite material—he liked the blue color. Although he never learned much English, he managed to do his own shopping by the expedient of pointing out the desired item in the store. He preferred the comforts of the museum, the chairs, a bed, the shelter, and the water that could be turned on and off, to the primitive life he had formerly known, and at no time did he want to return to his old way of life. Even the idea of a camping trip along Deer Creek did not appeal to him, but once reassured that he was not going to be left behind in the mountains, he agreed to go along.

When Ishi first came to civilization he was in perfect health, a typical specimen of the stocky California Indian type. He had never worn shoes or clothes, and he soon recovered from the hardships of his years of wandering after the break-up of the last village. He let his hair grow, became fat, and was contented with his lot. But he did not have the white man's immunity to the diseases

of civilization, and soon contracted tuberculosis. He died a few months after the onset of the disease.

After the tradition of his people Ishi was cremated with his bow, a quiver of arrows, and some food. His remains, placed in an urn, were deposited in a San Francisco cemetery. The inscription reads: "Ishi, the last of the Yahi Indians. Died March 25, 1916."

Unfortunately little has been written about the character and personality of this man Ishi. Primitive or wild men brought to civilization are common enough, and some people have been quick to point morals from the episodes, usually in favor of the simple life. The noble savage stoically accepting the complications of civilization, yet wasting away for the carefree life of his native heath is the familiar pattern for these incidents. During the days of Rousseau and Chateaubriand there was a deluge of this sort of thing, and some of it got tangled with the political thinking which underlies our own philosophy of government. Since the development of modern anthropology, however, this has gone out of fashion. It appears that the simple life is far from simple, but is complicated by customs as artificial as our own. Nevertheless, the character of Ishi indicates once again how much of our civilization makes no essential contribution to our spiritual well being.

Author's Note. The principal sources for the life of Ishi and the history of his tribe are the papers of T. T. Waterman and Saxton Pope, in *University of California Publications in American Archaeology and Ethnology*, Vol. 13, Nos. 2 and 3, 1918. There are some pamphlets by "old timers" of the region, of indifferent historical value, and hard to obtain, the best of which is "Fighting the Mill Creeks," by R. A. Anderson, Chico, California, 1909. Recently there has been published a series of studies, "The Conflict between the California Indian and White Civilization," by S. F. Cook *(Ibero-Americana*, Nos. 21-24, University of California Press, 1943), which cover the entire problem. No. III of this series, "The American Invasion, 1848-1870," deals especially with the reduction of the Indian population since the Gold Rush.

To understand Ishi, we must remember that not only was he the last of his people, he was also the survivor of a submerged culture in the midst of a complex one beyond his comprehension. All his life, until his final years, he had lived in the fear and belief that the white man would destroy him on sight. His people before him had trusted no neighboring tribe. Ishi, who loosed arrows at white men after being frightened away thirty-eight years before by another white man hanging a rope over a stout limb, had every right to expect that he had not long to live when caught in that slaughterhouse yard in Oroville. But times had changed. It was no longer the style to shoot or hang Indians simply for being Indians. Instead, he was given a warm room in a museum and befriended by men interested in the manners and customs of his people, and by a doctor who wanted only lessons in using the bow and arrow.

Perhaps it was simply because he was a stranger among people whose ways he did not understand that he seemed to be a gentleman, yet he did by instinct the right things according to the standards of the civilization in which he found himself. As Dr. Waterman wrote, "he convinced me that there is such a thing as gentlemanliness which lies outside of all training, and is an expression of inward spirit. He never learned to shake hands but he had an innate regard for the other fellow's existence, and an inborn considerateness, that surpassed in fineness most . . . civilized breeding."

Whatever the reason, this Indian impressed all who knew him as something more than the last survivor of a tribe whose bloody history was alive only in the memories of the older settlers. Not the stern and noble savage, for he had spent too much of his life in hiding to outface people with the glittering stare of popular tradition, but a gentle, kindly man who did his best to adjust himself to his new circumstances. He was lonely and unhappy at times, as anyone would be when reminded of the tragedy of his people, but he was usually serene and sure of himself.

It may have been the innate resources of a life spent among hills, trees, and elemental things that gave Ishi his spiritual strength and enabled him to adjust himself to such a different life from the one he had known for more than fifty years. A sympathetic visitor to the canyon in which he lived would like to think so. Even one who knows nothing of the story of Ishi would not be surprised to meet a ghost from the past around the next turning of the trail between the rough-hewn lava walls with their bright crusts of lichen and their smoke-darkened caves.

1

On a small nesting island in California's Salton Sea, we set up a blind of plywood and monk's cloth in a little valley facing one of the white pelican colonies. 10 a.m. temperature at 246 feet below sea level: 130° F. in the air, 160° F. on the sand. Result of several visits, we judged the pictures worth frying for—after wading two miles in hip-deep mud, then swimming, with cameras on a raft.

PHOTO DATA: **1.** *Shot at 1/300 sec. at f.16 on Triple S Pan film, using a 17" Dallon telephoto lens.* **2.** *Shot at 1/200 sec. at f.16 on Triple S Pan, using a 7½" f.4.5 Kodak Anastigmat lens.* **3.** *Shot at 1/100 sec. at f.16 on Triple S Pan, very late in the day, using an f.4.5 Kodak Anastigmat lens.* **4.** *Shot at 1/300 sec. at f.16 on Triple S Pan, using a 17" Dallon telephoto lens.*

2

WHITE PELICANS

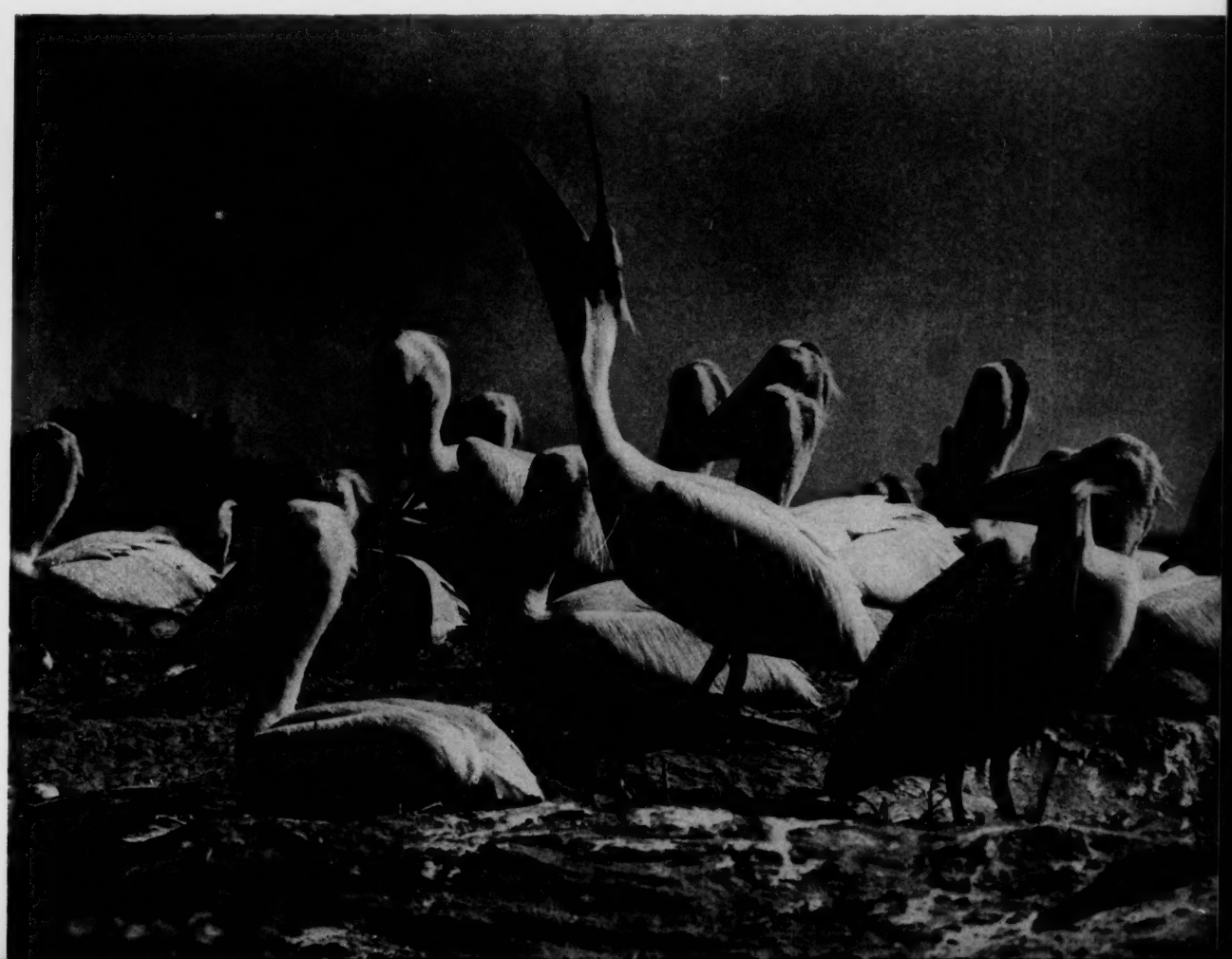
DON BLEITZ

3

1. *A fisherman returns to the colony. As he drops in for a landing the birds beneath him watch, beaks gaping.* **2.** *Baby pelican just emerging from the shell. He is waxy pinkish orange, almost transparent.* **3.** *Head starters. Most of the colony's young were still eggs which, instead of incubating, parents had to protect from the heat.* **4.** *A haul of fish goes down the hatch.*

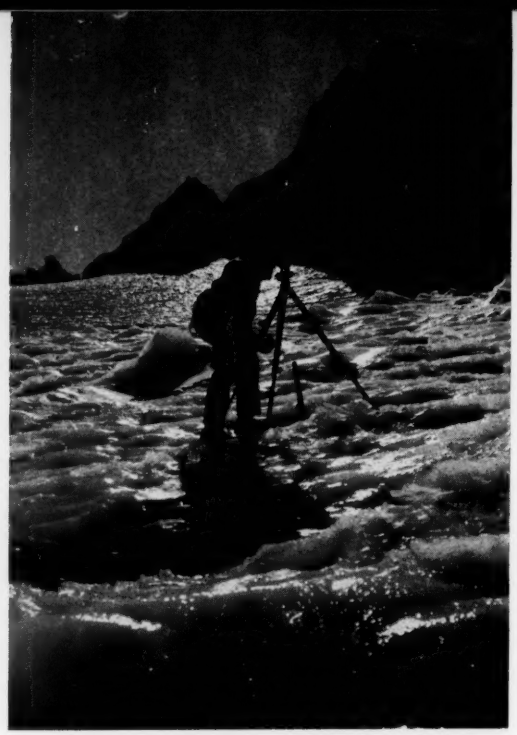
2

4



CALIFORNIA'S FROZEN WATER SUPPLY

OLIVER KEHRLEIN



Surveying Lyell Glacier. (National Park Service photograph)

WHEN THE WEATHER refused to perform according to schedule last winter, Californians were caught off balance and found themselves short of water. In the emergency, American democratic rights were overridden, an autocratic dictator was appointed by the Public Utilities Commission, and Californians were placed under severe electricity and water restrictions. The drought proved more of a threat than an actuality but made dramatic headlines while it lasted. No one expected it. Most people have already forgotten it—except the growers who lost crops dependent on normal winter and early spring rains.

Paradoxically, late spring caught the Columbia River basin with record-breaking high waters. Levees were undermined and broken through, villages were washed away, and damage mounted into the hundreds of millions of dollars. No one knows how many people were drowned. The river at length subsided, business was resumed, and another flood passed into the limbo of statistical data.

Both of these calamities struck suddenly and found us unprepared. And yet, meteorologists have them charted as recurring phenomena that have visited the Pacific Coast ever since man came. Glaciologists tell us that these two incidents were insignificant in comparison with similar manifestations in the past and in the light of what may be expected to happen in the future.

California could expect a drought every summer and the Columbia a flood every spring, were it not for nature's method of equalizing excess run-off and damming it back at the source with mountain snow-packs and glaciers. This is one way she has of providing for her lowland flora and fauna during the arid season. Man, imitating nature, has built for himself artificial dams and levees to restrain the surplus waters and conserve them for future use. In this he has done a pretty good job but his knowledge and means are limited.

He never knows how much nature will turn loose on him while he is doing his best to keep ahead of civilization's demands. He can forecast industrial and domestic needs by extending growth charts of business and population for the next five and perhaps ten years, but nature's performances are still unpredictable and will remain an enigma until man finds some sort of yardstick or cyclical formula to solve the riddle. Meanwhile, hydroelectric companies, thoroughly disturbed by recent events, are frantically filing for water rights on every possible site in our mountain streams, even looking into the national parks.

The power men might well be perturbed, for glaciologists tell us that apparently our climatic trend is toward a warmer and drier period. They base this outlook upon the continuous recession of glaciers all over the world during the past ninety years. Glaciers are extremely sensitive to variations

in temperature and humidity and their reactions can indicate a climatic trend long before man is aware of its initiation. These ice bodies can furnish us both a record of the past and a possible clue as to what to expect in the future. With this in mind, all accessible glaciers are being regularly studied and data on them accumulated. From these findings, being correlated by the Geophysical Union, it is hoped that some day a clearer understanding of our weather problem will be had.

History tells us that early in the seventeenth century many Swiss glaciers advanced down their valleys and engulfed nearby villages and meadows. These have lain buried under ice for centuries, though the glaciers have recently been retreating. Evidently this retreat started about 1860, so it can be inferred that the peak of our present ice age was reached somewhere between those two dates. Worldwide, this recession includes our own Sierra Nevada glaciers, of which some of the smaller have disappeared completely. One of these was that little glacier discovered in 1871 by John Muir in the headwaters of the Merced River, high above the Yosemite Valley. The announcement of this discovery brought Muir into bitter conflict with members of the U. S. Geological Survey. They contended that glaciers were impossible as far south as Yosemite, an easy mistake to make—with the peak of the cold cycle still gripping the mountains in a heavy blanket of snow.

To substantiate his claim, Muir painstakingly searched for further ice in all of the glacial cirques along the range. He found sixty glaciers. Although he missed a few and some of those he listed have since disappeared, his count checks closely with a recent census that gives us forty-nine live glaciers, seven static or dying remnants* and innumerable small glacial basins which at some time or other had contained glacial ice. From his studies and observations, Muir concluded that these were remnants of the great Pleistocene Ice Age and that the trend was toward a warmer and drier climate. In this he followed closely on the theory propounded by Agassiz.

In general this theory was correct—that is, if the broad view of some geologists is accepted and we consider the Pleistocene epoch and Quaternary period as concurrent and synonymous. In that case our "Little Ice Age" could be reckoned as a dwindling tag-end flurry, separated from the million-year-long Great Ice Age by the short, warm spell of a mere 5,000 years, but part and parcel of it. Being little finite creatures, however, and living right in the midst of this climate, we like to consider it normal for our time. Personally, we prefer to agree with those scientists who place the end of the Pleistocene epoch at about 9,000 years ago. This was followed by a 5,000-year warm, dry, and iceless period, much warmer than anything we are acquainted with. And finally, these men have now definitely determined that our own Little Ice Age and its glaciation started about 4,000 years ago—more than a few years after the pyramids were built in Egypt and had started on their way to decay.

With these facts in mind it might be interesting to allow our imaginations to go back to prehistoric times and to picture what California might have looked like under these varying conditions. So let us drop back a hundred or a couple of hundred thousand years ago into the middle of the Great Ice Age. The vast Laurentide ice sheet stretched from Labrador to the Rockies, while the deep Cordilleran ice mass blanketed the mountains of Alaska and western Canada and extended down among the higher mountains of the United States

* The author discovered 5 more dying glaciers this summer on the Kings-Kern Divide.—*Ed.*

A translucent blue-green grotto in Dana Glacier, 40 feet high and 150 feet long. Fine lines in the ceiling represent compressed annual rings. The heavier markings were gouged out by the uneven bed over which the glacier travels. (National Park Service photograph)

and along the Pacific Coast to the southern end of the Sierra Nevada.

To gain a comprehensive panorama of California's glaciated region in the Great Ice Age, we should board an imaginary plane near Mt. Lassen and fly south, keeping close to the crest of the range. In the northern sector where the Sierra peaks rise to about 7,000 feet, glaciation would appear to us quite spotty and very much as if we were flying above the middle, higher portion of the crest today. The timber line might reach up to about 5,000 feet and the ice would be confined to occasional glacial cirques on the north side of the higher peaks.

As we dropped down for a closer scrutiny of the Donner Summit region, so familiar to the skiing fraternity, we would be reminded of the clusters of merging glaciers seen in the Selkirks of Canada. Below us, this area appears as an irregular pattern of ice, very much like a shriveled starfish, 250 square miles in extent. To the north, the main body of the glacier reaches high onto the buttresses of Castle Peak; to the south it buries, under a thousand feet of ice, the famous Sugar Bowl and nearly smothers Lincoln, Anderson, Tinker Knob, and Squaw Peak. Westerly arms, fifteen miles long, wind down the Yuba and American River Canyons, while foreshortened branches drop eastward to gouge out the historic Donner Lake and to widen Squaw Creek Valley and the other tributaries of the Truckee River and Lake Tahoe.

As we travel farther south and the mountains rise higher and higher, the clusters of glaciers become larger and their ice streams longer until groups begin to merge together and lose their identity. Such a succession of crest glaciers can be found now in the British Columbian Coast Range heading up toward Waddington and the Tiedemanns.

Then suddenly the terrain below us fills in completely with glistening white ice, rising and swelling toward the eastern skyline. There the snow horizon is irregularly broken by sharp pinnacles

and heavy buttresses of contrasting gray granite. To the west, long tongues of ice stretch down the river channels into the haze above the foothills, and suggest the ghostly tentacles of some titanic octopus reaching for the sea. We are over the watersheds of the Tuolumne and the Merced in the Yosemite National Park—and they are blanketed by a glacial system eighty miles long and forty miles wide. We have here an ice cap formation similar to that great dome of ice in Alaska, the common névé or fountainhead for the coastal glaciers, Norris, Taku, Mendenhall, and Denver, and the inland glacier of Llewellyn which acts as a source for Lake Atlin.

In our search for familiar landmarks we note the truncated summit of Tower Peak and, close by, a jagged line of rocks sticking out of the snow—which might be the Saurian Crest. The Matterhorn is readily identified as the pyramid on the northeastern horizon, with the nearby massive pink western face of Conness rising against the blue sky. As we reach the spot where the Tuolumne Meadows and Lembert Dome lie buried deep beneath the ice, our eye is caught by the two sharp spires of Cathedral Peak and Unicorn, two solitary lighthouses in a motionless sea of white. Beyond them a knife-edge rib of rock, beginning to shatter, might be Cockscomb Ridge. These island summits are called *nunataks* by the Eskimos. Dropping lower, we run into a group of massive granite domes, barely flush with the surface of the snow, and realize that we are over the Yosemite region. There is Clouds Rest's elongated summit, and here is the bald top of Half Dome with its west face rounded and still unsplit. We turn east again, leaving the gray domes of Sentinel, Starr King, and Moraine to our right.

For one fleeting moment we are treated to a bird's-eye view of one of those spectacles that stops travelers on glaciers in awe and then holds them in fear—a vertiginous ice-fall. Vernal and Nevada Falls are here frozen into immobile cataracts of gigantic ice blocks, wide-yawning crevasses, and crazily leaning seracs—both tumultuous masses on the verge of toppling and shattering in thunderous avalanches.

We hold to our course up the main glacier, following a series of parallel dirt-streaked medial moraines toward the eastern horizon until we reach the high point of a great white dome, which must be the névé of glaciers about Lyell's summit. We search for the familiar mountain masses of Lyell and Maclure, but instead find only a sprawling thin crest-line of rock on the white snow. From the sides of the dome glaciers break away to the four points of the compass: eastward into Rush Creek; northward the Tuolumne Glacier, which will run its course of sixty miles before it melts away in the valley heat; westward the Merced; southward the greatest of them all, the San Joaquin Ice Sheet.

This ice sheet is a true *mer de glace*—sea of ice—extending as far as the eye can see—1,500 square miles of snow and ice flowing into and merging with the frozen blanket covering the basin of the North Fork of the Kings.

We drift lazily south over the glaring expanse, trying to orient ourselves. Finally we spot Mt. Goddard's dark hulk coming up on our right; to our left, standing aloof on the skyline, tall Mt. Humphreys—its sheer western face scarred with vertical streaks of snow. This snow seems to be continuously avalanching and cutting deeper and deeper the flutings which are to give it its beautifully sculptured architecture. Then suddenly we perceive Mt. Darwin's square flat summit and in the distance the dark foreboding cliffs of the long Palisade crest stretching for miles in a battlement of turrets.

As we approach the highest point of North Palisade the expansive ice sheet gives way to a more definite pattern of glacial rivers between mountain chains. Below us lies the deep Middle Fork of the Kings collecting strength from its lateral ice streams out of LeConte Canyon, down off Dusy Basin, and a strong, straight branch from the east pouring out of Palisade Creek. This scene begins to look like our familiar contour map, but with the streams marked broadly in white. Down these white streams run the dark medial markings, each keeping its proper distance with mathematical precision, following every twist and turn of the canyon as if lined in with ink by some meticulous artist.

Next and even more striking is the great glacier of the South Fork of the Kings with curiously striped Cardinal Mountain at its head and the pyramidal masses of Arrow Peak and Pyramid Peak to the south. This majestic glacier swings down Muro Blanco's high walls in a wide sweep; gathering strength and volume from Woods Creek canyon, it fills Paradise Valley high up onto Goat Mountain, around which it disappears into the Kings Canyon to the west.

Glacial annual rings. The ice near the terminus, to the right, contains snow which fell about the time Columbus discovered America. When it fell, a mile to the left and 1,000 feet higher, the snow blanket was 20 feet thick. It has traveled slowly downward and has been compressed into a layer 4 inches thick. (Photograph by J. W. MacBride)

Mills Glacier, typical small Sierra glacier, protected by an ancient amphitheater (cirque) at its upper steep névé and disappearing a half mile below under its horseshoe of morainal mounds. During the Great Ice Age, this valley was filled with ice, 1,000 feet thick, 4 miles long. The surface of the glacier in those days reached within 100 feet of the summit of Mt. Mills. (Photograph by J. W. MacBride)

From here we rise above a jumble of mountains and glacial amphitheaters with a maze of tumbling glaciers, like the small branches of a great oak, finally merging into one twisted and gnarled main trunk which drops down into Bubbs Creek canyon. Here as we cross the Kings-Kern Divide and peer down into a flat, wide, open glacial cirque, the scene changes from a nightmare of convoluted mountains and glacierets to a placid single glacial system. Here one is wont to pause—as many a climber has done—on the summit of Mt. Stanford and study the jagged rim of this great basin, twenty miles across, and to wonder at the simplicity of the Kern Canyon as it takes off to the south. Small tributary glaciers converge into the main trunk from the Divide, from Whitney's Crest and the Great Western Divide, to build up an ice river that flows straight as an arrow into the southern sun as far as Hockett Peak, twenty-five miles away. As we follow it south we pass on our right Thunder Mountain's splintered summit, flat Table Mountain and the monolithic shaft of Milestone, and on our left the 14,000-foot crest above which rises the humpbacked, unglaciated plateau that is Mt. Whitney, highest of them all.

In a short time the ice is behind us, the spell is over, and we are again above green forested valleys and mountains with blue lakes and rushing streams, the type of Sierra we know best. Our plane veers to the east and dives down to a landing on the Mohave Desert, hot, parched, and lifeless. It is a sudden transition from the eternal snow to a place that has never known ice. And yet it is just such a transition that took place at the end of the Pleistocene, when the last glacier melted away and California became an arid state.

So let us look back to that turning point, 9,000 years ago, when temperatures were far hotter than they are today and when there was no ice in the mountains, not even in the glacial amphitheaters of our highest peaks. These alpine bowls, still retaining their glacial polish, are now littered with rocks and boulders, fallen from the surrounding cliffs. The streams and meadows have gone dry, except for an occasional trickle in springtime. All of the waters from the great frozen sea of the sky have returned to the ocean. The mountains, hills, and valleys have become desolate with only sparse and straggly shrubs and tawny weeds struggling to perpetuate their kind. California has returned to the desert—arid and inhospitable.

Glaciers, the world over, have responded to the

depleting heat and a universal drought is parching the land. Atmospheric humidity has become concentrated in the cloud banks near the equator and there the jungles grow lush in the increased heat and moisture. Over the ensuing centuries, this jungle spreads slowly north and south to encroach on an arid world. Gradually new forces are being marshaled for the initiation of another climatic cycle. The ocean level, now hundreds of feet higher, backs up into the bays and inland valleys. Our own San Francisco Bay becomes a broad arm of the sea, with submerged land where San Francisco's business section now stands, and only its hilltops visible like so many islands along with Alcatraz and Yerba Buena. Brackish waters fill the Sacramento and San Joaquin Valleys, turning them into a vast swamp reaching from Bakersfield to Red Bluff. In this swamp vegetation grows rank, layer on layer, to build up peat beds for future farmers.

Increasing summer temperatures draw great volumes of moisture from this inland sea, leaving the salt behind to poison the soil. The atmosphere, heavily laden, is sucked toward the cooler mountains, to condense there in billowing clouds. These merge with both fogs from the oceans and the cloud banks from the Equator to obscure the sun, and thus a new and wet cycle is again on its way.

It was during this period that the world's most devastating floods took place. Cloudbursts poured down the polished glacial troughs to accumulate power and speed as they reached the foothill sedimentaries. These they carried on with them in a dirty raging torrent to spread them as great fans of silt in the valleys. It is said that the great Biblical Deluge occurred during that time, flooding the countryside up to the summit of Mt. Ararat—17,000 feet above the sea! This we do know: it was during these warm and humid days that the minute seeds of the *Sequoia gigantea* germinated and took root in our land. Here these giant trees have stood, during centuries of storms, the only witnesses to the birth, and possibly the future death, of our own Little Ice Age.

This minor ice age has been a semi-arctic period, much to the liking of human, animal, and plant life. At present this mild form of glaciation is evidenced in our Sierra Nevada by some forty-nine small glaciers hidden away in ancient glacial cirques high above timber line. Their range extends from the Sawtooth Ridge in the northeast corner of the Yosemite National Park to the Palisades on the eastern border of the Sequoia–Kings Canyon National Park.

Main glacier on the Minarets from the air. One of the small spectacular glaciers of the Sierra Nevada, it feeds the Middle Fork of the San Joaquin River. This is one of the few Sierra glaciers which has not built up a morainal system; the detritus carried down by the ice drops into Upper Iceberg Lake. (Photograph by Francis P. Farquhar)

In appearance, most of our Sierra glaciers follow a similar pattern, often referred to as the Sierra Nevada Type. They are usually small, oval or pear shaped, with their broader heads (névés) confined within old and well defined glacial amphitheaters. Their upper edges are usually separated from the cliffs of the headwalls by a ragged bergschrund (crevasse). From this line the snow drops off steeply for about one third of the length of the glacier, and in summer is melted in deep furrows and sun pits. As this snow travels downward it compresses and levels off into a flattened plateau for the middle third. These two upper sections are often seamed by horizontal crevasses which may prove hazardous while covered with fresh snow during the early summers. The lower and narrower third is icy and marked with annual rings or laminations, each representing the snowfall of a single season that has been compacted and forced forward by the weight behind. These annual markings number from forty to a hundred on the smaller glaciers and up to two hundred on the larger. As the ice approaches the terminal moraine, it becomes more and more littered with rocks and boulders carried down by the movement of the glacier. Surrounding this lower end is a rocky horseshoe formed by the two lateral moraines converging around the terminus to form the terminal moraine. These morainal systems are usually disproportionately large for the size of the glacier and frequently show a succession of mounds pointing to periods of excessive activity. Unlike the Swiss and Alaskan glaciers, the Sierra glacial termini have not been melting back during the recent period of recession, but have remained confined within and often buried by their moraines. Their recession is usually shown by the lowering of the level of the surface of the ice. A perfect example of this type is the Mills Glacier at the head of the Second Recess above Mono Creek.

In the Minaret-Ritter-Lyell group are noted three wide variations from the regular Sierra type. One of these is the small glacier on the north side of Clyde's Minaret. While it originates in a typical cirque, it ends in a well formed ice terminal which overhangs the brink of the glaciated wall above Upper Iceberg Lake. No morainal system is built up as the detritus, carried down by the ice, is dropped into the lake.

The second exception, while unlike any other Sierra glacier, is typical of the usual river of ice found elsewhere in the world. It is that narrow ice stream which starts at the saddle between Ritter and Banner and flows down between two long ridges to a small ice-bound lake. California has another of this type in Whitney Glacier on Mt. Shasta.

The third exception is perhaps the best known of all our glaciers. It is the Lyell Glacier in the Yosemite National Park, the second largest glacier in the Sierra. Its two lobes, separated by a long knife-like cleaver of granite, measure nearly a mile wide by three-fifths of a mile long. It can be readily seen from the Tioga Road and appears to be a broad rectangular snow field hanging on a high shoulder of the mountain. Without a typical amphitheater, it takes off along a straight line from the narrow ridge of rock which forms the flattened summit of Mt. Lyell. Its terminal moraine is a long undulating mound of boulders overlying the northern edge of the ice. It has but one lateral moraine and that is at the west end.

Lyell Glacier has been regularly visited since John Muir first explored it in 1872. It has been studied and measured annually since 1931 by the rangers of the National Park Service. Among other things, these men have determined that the ice at the center of the glacier's surface travels at a rate of approximately one inch a day. They have also found that the surface of the ice is lowering at a rate of five feet a year on the easterly lobe, and nearly two feet a year on the westerly lobe.

Sixty miles farther south lies the Palisade Glacier, the largest in our Sierra, a mile long and a mile and a half wide. Its setting is spectacular, with three of our most dramatic peaks forming a scenic backdrop for its amphitheater—heavily buttressed Mt. Sill (14,100 ft.) to the east; the jagged crest of North Palisade (14,254 ft.) to the south; and the sharp needle of Thunderbolt (14,060 ft.) to the west. Its wide-lipped bergschrund swinging around in a gigantic semicircle at the base of this high granite enclosure opens up into deep blue-green grottoes festooned with weird ice and snow formations. The upper portion of the glacier is lined with small crevasses which can prove hazardous during the summer while still covered with snow. In the southeast corner, where the ice breaks over into an adjacent basin, there is a collection of larger crevasses, fifty and sixty feet deep. These cracks, now only three to four feet wide, were five times their present width twenty years ago, when we first visited the glacier. An out-

The Minarets from Lower Iceberg Lake. This photograph was taken 10 years earlier than the one on page 23. Comparative study of these pictures leads the author to believe that the main glacier has apparently advanced in the last 10 years. (Photograph by Ansel Easton Adams)

standing feature of Palisade Glacier is the presence at its lower end of hundreds of pedestal rocks, standing like monstrous mushrooms on tall columns of ice where the sun has lowered the level of the glacier all around. As they reach a height of eight to ten feet the sun's rays melt these pedestals and the overhanging granite caps topple off.

Palisade Glacier is now being studied and surveyed at regular intervals by the American Alpine Club. This being the most southerly glacier of representative proportions, it is expected that valuable climatic data will be derived from these studies. It too is showing the effects of the present warm cycle, its surface having dropped some fifty feet during the past twenty years.

If the ice in the Sierra continues to melt at its present rate, all of it will have disappeared completely within the next hundred or hundred and fifty years. California might then become a hot and arid state. This, however, may be only a minor cyclical rise in temperature and the trend may reverse itself at any time and start piling up the snow and rebuilding the glaciers. This reversal of climate and lowering of temperatures could result from any one of several natural causes—such as an increase in sun spots; a change in ocean currents; a shift in terrestrial poles—to mention a few. We can even suggest a man-made cause:

Man has been equalizing his water supply by building artificial dams and lakes, very much as nature does with her snow banks and glaciers, higher up. With these impounded waters our rainless valleys are being irrigated and converted into evergreen farms and orchards. Trade winds coming in from the west will pick up more and more moisture from these plantings and carry it high up onto the mountains where it will condense into increasing banks of clouds. So as a result, our summer storms should become more frequent and as the years run on the average temperature would drop. This drop may be little, but, according to Dr. Gilbert N. Lewis, it does not take much, as long as this little persists constantly, to reverse a climatic cycle and bring on an ice age.

Thus it may be possible that man, by interfering with the regular balance of nature's distribution of water, might be able to compensate for the extremes in weather on a state-wide basis. He is already, with partial success, causing local rains by scattering dry ice among the clouds. Going a step further, man might upset the electric potential in the clouds by means of electronic waves—but we had better stop here. For the present California has a wonderful climate and let us hope it stays this way. Meanwhile it is up to us to guard against devastating floods and build up our water reserve and not waste a single drop of the excess now running uselessly into the sea.

Gold Men and Fishermen

Engineers Reply to "Gold, Men and Fish"

EDITOR, *Pacific Discovery*
SIR:

It was with appreciation and pride that I read the first issue of *Pacific Discovery* but on opening the covers of the second issue and reading the Conservation article, "Gold, Men and Fish," by Joel Hedgpeth (I have) considerable apprehension as to the propriety of the Academy publishing propaganda articles.

When (I was) acting as Chairman of the Mineral Resources Committee of the Commonwealth Club a number of years ago a study was made of the rejuvenation of hydraulic mining in California. At that time and on several subsequent occasions that subject, as well as that of fish, has come up for consideration in various committees. There are clearly two sides to the question. For the Academy to consider one side only and in an article that hints at the abolition of our oldest California mineral industry cannot and will not redound to the fair name of the Academy as a first class scientific organization.

WALTER STALDER

San Francisco, April 28, 1948

EDITOR, *Pacific Discovery*
SIR:

Under the heading "Conservation" in *Pacific Discovery* for March-April 1948 (Vol. 1, No. 2) was reprinted an article by Joel Hedgpeth, "Gold, Men and Fish," which first appeared in *The Land,* Summer 1946 (Vol. V, No. 2, pp. 202-206). This article accuses the gold mining industry alone of having virtually destroyed all fish life in the Yuba and American Rivers, especially salmon, and asserts that construction of the debris storage dams already erected or proposed in the watersheds of these rivers will put them "beyond hope of redemption," and as a corollary gold mining should be abolished.

The article is so inaccurate in some of its statements and so bitterly prejudiced in its general tenor and conclusions that to a person well informed on the subject discussed it has no merit whatever as a scientific statement, but rather is to be classed as malicious propaganda.

Mr. Hedgpeth is a fish biologist now with the Institute of Marine Science of the University of Texas, at Port Aransas. In the summer of 1938 he was a field assistant between July 1 and November 3 in "A Biological Study of the Effect of Mining Debris Dams and Hydraulic Mining on Fish Life in the Yuba and American Rivers in California." That is the title of the report submitted to the United States District Engineer's Office at Sacramento, California, dated May 1, 1939, by H. F. Sumner, Assistant Aquatic Biologist, U. S. Engineer Corps.

The report is well written in temperate style, and it is evident that the author has tried to be objective and impartial. The whole effect therefore is vastly different from Mr. Hedgpeth's perverted version of practically the same subject, although Mr. Sumner does make several statements which this writer knows to be incorrect, with subsequent erroneous conclusions therefrom.

To qualify as a critic of these papers, the writer's education through high school was nearly all received in Sacramento, under the powerful influence of the violently anti-hydraulic mining *Bee* and in a family having a ranch behind levees near Courtland, 20 miles below Sacramento. As a mining engineer he has had much experience in the area under discussion, especially along the Yuba River, both in mining operations and on a hydro-electric power project, including *construction of the Bullard's Bar Dam.*

Also, after deciding to reply to Mr. Hedgpeth's article, the writer made a two-day trip via Dobbins and Camptonville to Downieville, to check up on various things. He has statements from several old residents, all well known and reliable men, each of whom expressed willingness to be quoted by name, if needed, regarding fish life in the Yuba River for as far back as 50 years and more.

When referring to "salmon" we will mean the true salmon (also known as quinnat, chinook or king) which invariably dies after spawning. They average over 20 pounds, with occasional fish up to 70 pounds or even more. By "steelhead" will be meant the sea trout or salmon trout, which is much smaller, not exceeding 30 inches in length and does not usually die after spawning. The salmon are much the more important as a commercial food fish, and there are no runs of either into streams south of the Golden Gate. The runs of salmon are increasingly large farther north, going into the Klamath, Columbia, Fraser, etc. Salmon also go up the heavily silted Alaskan rivers, even for over 2,000 miles up the Yukon, which is one of the muddiest of all rivers at all seasons.

The principal accusation by Mr. Sumner is that erection of the debris storage dams cuts off the salmon from about three-fourths of their natural spawning areas on the Yuba River, and from perhaps somewhat less than 44 per cent on the American River. Fish counts were made of salmon at Daguerre Point Barrier Dam on the main Yuba River, and at the Folsom Dam on the main American River during the fall of 1938, but no mention is made of any attempt to determine how far they went upstream beyond these points.

The Daguerre Point Dam was built in 1910 by the U. S. Engineer Corps for debris control, and as the

river channel has been washed out below, a fall has developed that now appears from the bank above to be about 15 feet. The fish ladder is at the south end away from the main stream flow, where only a very small part of any run could possibly find it. The Hallwood Irrigation District diversion through a tunnel at the north end has existed since 1911, without screening, capacity 175 sec. ft.

The Folsom dam was built in 1888, is over 80 feet high and had no fish ladder until 1931, according to Mr. Sumner. The diversion canal for power purposes is eight feet deep and 40 to 50 feet wide, capacity 1,200 sec. ft., no screen.

From all information the writer has obtained from North Yuba District residents it seems certain that very few *salmon* ever ascended the Yuba River much above the Narrows. Above that point for many miles are deep, narrow, rocky gorges with rough bouldery bottoms and practically no bars of small gravel. Below, the stream is wide, with flatter grade and many gravel bars suitable for spawning. Therefore, construction of an adequate fish ladder, properly placed, at Daguerre Point would "restore" the Yuba River for salmon practically to early day conditions, except for the vastly increased fishery hazards a run would encounter in the bays and coming up the Sacramento River.

With regard to the steelhead run which did go farther upstream, they were stopped by the 40-foot Colgate diversion dam on the North Yuba, built in 1893 by the Browns Valley Irrigation District. Purchased by the Pacific Gas & Electric Company in 1903, it has been used only for power since, with no fish ladder until 1915. In the middle Yuba they were at least partly stopped by the 15-foot natural falls about three-fourths of a mile above the junction, and on the South Yuba by the diversion dam of the Excelsior Ditch about 10 miles above the junction, used for irrigation for many years past.

The Upper Narrows debris storage dam now cuts off all three branches, leaving only Dry Creek, three-fourths of a mile above Daguerre Point, for spawning ground to the north. Deer Creek, coming in from the south just above the Narrows, has impassable rapids and falls just above the mouth.

There have been big runs of steelhead up Dry Creek since the Daguerre Point Dam was built and before the falls became too high for the fish to pass. So the adequate fish ladder for salmon also should revive the steelhead run to some extent.

In resumé, therefore, the gold mining industry positively cannot be blamed for the reduction in *salmon* runs due to obstructive dams on the Yuba or American Rivers during the last 50 years. The dams at Colgate diversion and Folsom are for power use only, and the big ditch diversions into which seabound fingerlings are drawn to die at Daguerre Point and Folsom are respectively for agriculture and power. The same argument is *also true in large part regarding the steelhead.*

Mr. Hedgpeth states as a fact, and Mr. Sumner says "According to an engineer," that when Bullard's Bar dam was being built during 1921-24, so many *salmon* congregated and died below it that they had to be burned (or "carted away and disposed of"). Mr. Hedgpeth says "This massacre of a salmon run received no publicity, and few outside the district are familiar with the facts."

The two versions are slightly different but neither is true. Their story probably springs from the fact that several times *steelhead* congregated below the Colgate diversion dam in considerable numbers. Local residents dynamited the fish and even poisoned them by putting bluestone into the pool. On one such occasion, the dead fish were numerous enough to be a nuisance as they decayed, so were gathered together and burned.

Both Mr. Sumner and Mr. Hedgpeth assert that the debris storage reservoirs are not efficient settling basins. This is contrary to natural physical laws and actual experience. Another convincing answer is that power plants are operating below the Bullard's Bar and Yuba Upper Narrows dams.

It is true that an injunction was granted stopping mining above the American North Fork dam under certain conditions of turbidity of the water, "to protect the irrigated fields" according to Mr. Hedgpeth. Looking down upon this lake from above, the water probably appeared much discolored because of the dark background below, but when held up in a glass it would be only slightly cloudy, with exceedingly small content of solid matter.

No ordinarily reasonable person would say that such water can injure irrigated fields. It probably does not contain one hundredth as much solids as the water pumped from the Sacramento River each spring onto the lower island farms for irrigation.

The beneficial effects of the dams on improvement of the stream channels below by also impounding large volumes of natural erosion debris need not be enlarged upon here.

The effect of mud or silt in the water upon fish life is a much debated problem. Mr. Sumner states that silt and mud interfere with spawning, but seems somewhat undecided about any actual ill effect upon the fish. A natural inference would be that murky water might help to hide and protect the freshly hatched fingerlings.

However, the effect of mud and silt from mining operations cannot hereafter affect the spawning of either salmon or steelhead in the lower reaches of the Yuba and American Rivers. Any silt which can pass through the settling basins and over the dams cannot possibly settle out of the more swiftly flowing

stream below, which actually will be picking up rather than depositing material until it has the normal load for its volume and slope of channel.

On these streams, therefore, there will be two distinct zones of fish life, with the debris storage dams between. On many other streams in California there are or will be numerous high dams for water storage and flood control or for power, which makes this situation rather prevalent.

Mr. Hedgpeth says:

"It cannot be reiterated too often that it is possible to restore fish to an undammed river, or enable it to restore itself, but a stream cluttered with dams and mining debris is beyond hope of redemption."

And also:

"After several years, a stream may run clear again and the fish may work down from the high country above the mining district or upstream from the river, if there are no dams. But the construction of a dam, especially a high debris dam designed only for the purpose of holding mud, means an end to any hope of restoring a river."

Undoubtedly he refers to mining mud here, but mud from natural erosion acts precisely the same, and eventually any dam will become filled to the crest whether there is mining above it or not, and the effect on fish is identical.

For instance, measurements behind the Bullard's Bar Dam by the California Debris Commission show:

	cu. yds.
Total Debris deposited from 1923 to Jan. 1939	7,706,000
Mining Debris by mine bank measure . . .	2,522,000
Debris from effects of natural erosion . . .	5,184,000

For 15 seasons this averages 352,000 cu. yds. per year from the North Yuba drainage alone, which is in a heavily forested area with less than average natural erosion. However, since 1939 there has been a big increase in lumbering in this basin, with much new road building, clearing of land for small farms, etc., so that the present rate of natural erosion may be nearly double what it was then.

Above the dams, we are concerned mainly with trout, and the effect of muddy water upon them with regard to growth and propagation.

Our old timers all agree that muddy streams from placer and hydraulic mining did not appear to hurt the trout. After mining operations ceased usually before July 1 each season, until the rains came usually early in October, the river and side streams would clear up for about three months and trout fishing with some steelhead would be excellent, with plenty of big trout. Of course, some trout could be caught even in the muddy streams, but not like when they could see a fly.

This agrees with the findings of the late Dr. Henry B. Ward of the University of Illinois as published in *Science*, the magazine of the A.A.A.S., in the issue of Friday, Nov. 11, 1938—New Series Vol. 88, No. 2239. The title was "Placer Mining and the Anadromous Fish of the Rogue River." This article dealt primarily with salmon, but his general observations would appear to apply to most fish. This was bitterly disputed by Mr. Hedgpeth, whose main concern appears to have been to make a strong showing against the mining of gold by any method.

The old timers again agree unanimously that the lack of fish is chargeable almost entirely to one cause —*overfishing*. As one said, there are "over a hundred fishermen now to one in those days."

In the stagecoach and horse-and-buggy days the population was about one-tenth of what it is now in California. Also, nearly everybody worked a full six days of longer hours, and there was much less time and money to expend on fishing trips. It is not astonishing that, with the construction of many new highspeed access roads, quick transportation by automobiles, and great numbers of fishermen with plenty of time and money, the trout have become so badly depleted. And so they are, in spite of the fact that State hatcheries put vast numbers of young fish into our mountain streams and lakes each year. But the fault does not lie with the mining industry in this state.

Undoubtedly a stream, any stream, can be "restored" in the meaning of repopulating it with food or game fish, provided that effective laws and law enforcement will see to it the young fish are not jerked out as fast as they are put in. But will the sportsmen stand for that, while they are so much more numerous and politically powerful and the blame can be laid on the miners?

Please note that all of this fuss is over three or four dams on two rivers, and then let me quote from an article in *West Coast Sportsman,* Vol. 5, No. 6, issue of June 1948. The title is "Importance of Fish Screen and Ladder Program," by Richard Croker, Chief of Bureau of Marine Fisheries, California Division of Fish and Game:

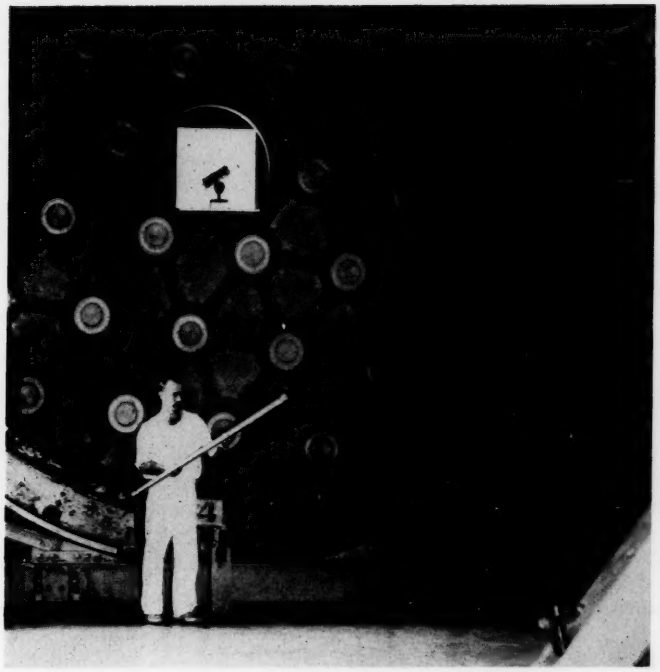
"To permit the spawning fish to ascend our streams obstructions such as dams must be equipped with fish ladders. To allow the baby fish to return down the natural streams instead of being lost in fields and orchards, California's numerous water diversions must be screened adequately. . . .

"In our State are hundreds of dams and thousands of diversions on salmon and steelhead streams. . . .

"Hazards to migratory fish in the Sacramento-San Joaquin River System include a great many high dams and enormous water diversions, some of which remove almost all of the water from the streams. Many of these exist on main rivers where they affect the entire run of fish. . . .

"The increased emphasis of water in the State's economy and very existence has threatened seriously the migratory fish populations."

This is a realistic appreciation of the impact upon the migratory fish of our vastly increased population with its skyrocketing demand for storage of water to



An Error of Astronomical Proportions

A correction to PD *for May–June 1948: In the Astronomy article "Discovery in Space" by Earle G. Linsley there was a picture on page 20 like the one here to the left—almost. The caption called the small instrument shown in the center of the 200-inch a replica of Newton's one-inch reflector. Dr. Linsley brought it to the art director's attention that he had used the wrong photo. Here is the right one, with Galileo's telescope (in replica) in the hands of Melvin Johnson, and Newton's in the center. The editor apologizes for the AD's careless slip but wonders why some telescope-wise reader didn't write us a letter. (Photograph by Edison R. Hoge)*

meet domestic, power, industrial, and agricultural requirements.

Mr. Hedgpeth's attack upon gold dredging is virulent but not logical. "There are piles of gravel defacing meadows which might have been more profitably left to livestock grazing."

Admittedly, the dredge tailings piles mar the view to the strictly idealistic nature lover, but the gold from them helped to pull this state through two bad depressions. The wealth produced from fair dredging ground per acre might be accumulated only during several generations of ordinary agricultural use, and probably in not less than a century, if ever, as grazing land.

Excluding the originally unproductive riverbeds and gravel bars, the area dredged of possibly arable lands can be counted in hundreds, out of five or six million acres of arable or grazing land in the Sacramento Valley.

For a comparison of such land destruction by mining as against other preventable wastage, read "The Eleventh Commandment" by Walter C. Lowdermilk in the May-June 1948 issue of *Pacific Discovery*. Speaking of erosion of overgrazed or improperly deforested areas in this country alone, he writes:

"This enemy of civilizations has already destroyed or seriously impoverished 282,000,000 acres of American lands and impaired the productivity of 775,000,000 acres more."

Roy H. Elliott

Berkeley, July 26, 1948

SAVE THE REDWOODS

Send 10 cents each for these attractively illustrated pamphlets: "A Living Link in History," by John C. Merriam. . . . "Trees, Shrubs and Flowers of the Redwood Region," by Willis L. Jepson . . . "The Story Told by a Fallen Redwood," by Emanuel Fritz . . . "Redwoods of the Past," by Ralph W. Chaney. All four pamphlets free to new members—send $2 for annual membership (or $10 for contributing membership).

SAVE-THE-REDWOODS LEAGUE
250 Administration Building
University of California, Berkeley 4, Calif.

OUR PLUNDERED PLANET. By Fairfield Osborn. Little, Brown and Company, Boston. 1948. xiv + 217 pp. $2.50.

This book, if widely read and its message heeded, may well have a greater impact on human thinking than the atomic bomb. It points out clearly that, even without the aid of this interesting weapon, civilization is headed toward disaster. As one reads, he comes more and more to feel that the nations of the world are like seafarers quarreling over a game of cards while their ship goes down.

If anyone expected from Mr. Osborn's pen a book on conservation along stereotyped lines, he will be surprised both by what has been included and by what has been left out. There is no dirge for the passenger pigeon and the heath hen, no mention of the ivory-billed woodpecker and the trumpeter swan. Not even stream pollution, nor the preservation of wilderness areas, come in for treatment save by implication. Not that the author is uninterested in these matters—elsewhere he has attended to them earnestly, and as President of the New York Zoological Society he has battled for conservation on many fronts. But in this volume he is concerned with a more fundamental problem: Can civilization survive in the face of growing population pressure and man's historic tendency to destroy the very resources on which his life depends?

Approaching his subject from a cosmic point of view, Mr. Osborn considers briefly the place of the solar system in the stellar universe, the place of the earth among the planets, and man's place in nature. Peering down the dim corridors of pre-history to human origins perhaps a million years ago, he visualizes early man as relatively defenseless among his animal contemporaries, living by his wits. The primitive emotions of fear, anger and pugnacity, combined with the degree of mastery achieved through the use of tools and weapons, led to aggressive and destructive types of behavior that have persisted even to the present day. It is worthy of note that the history of civilization covers less than one per cent of the period during which human beings have roamed the earth. Man has become "civilized" but his instincts have not.

Aggressive tendencies stemming from his past lead man to war—warfare with his own kind and, perhaps even worse, warfare with nature. His approach to nature is traditionally one of conquest. He must attack the environment, defeat it, change it, bend it to his will. Significantly, the development of western North America was symbolized by the phrases "subjugating the land" and "conquering the continent." The truly remarkable progress of science in recent decades has contributed to the illusion that technology can substitute for nature, and has at the same time vastly increased man's ability to alter his environment. For the first time, man has become a geologic force.

The decline and disappearance of ancient civilizations gives melancholy testimony to the fact that man's effect on his environment is usually to render it uninhabitable. He settles in a rich, well-watered region and in the span of a few lifetimes converts it to a desert. The land is misused, too many sheep or goats or cattle are grazed upon the hillsides, the forests that hold the life-giving water are cut down. Rainfall, once beneficent, now becomes an agent of destruction, carrying away the precious topsoil to the sea. Agriculture dwindles. Gaunt domestic animals compete for the last vestige of food on gullied hillsides. Wind-blown sands complete the desolation.

Large areas of the Near East known to be centers of agriculture in Biblical times have been claimed by the desert. North African cities, prosperous in Roman days, are buried in sand. Climatic changes are often invoked in explanation; but, says Mr. Osborn, "There are no real evidences of the geologic desiccation of a region, namely from natural causes, within historic times . . . Palestine has today the same general weather conditions that it had in Biblical times. A small stand of cedars of Lebanon, untouched for many centuries because it was considered a sacred grove and was protected by a wall which kept out goats, supports the opinion that weather was not responsible for the loss of all the immense forests of cedar which existed within historic times."

In earlier days when man had ruined his land he could move to a new location and start over. But that trail has come to an end. Today the world is full, much of it overcrowded. It requires two and one-half acres of productive soil to feed adequately one human being, and there are only four billion acres of arable land in the world to support a present population in excess of two billion. Hardly two acres per person! And year by year the population grows, and year by year the land washes into the sea.

In the most populous areas of the world, for example India and China, millions of people are condemned to starvation or permanent hunger. European populations struggle at the margin of subsistence. In the New World population pressure is less, but the prospects for the future are hardly brighter. South America has been called a "vanishing continent," vanishing from uncontrolled erosion; and of the United States Mr. Osborn writes: "The story of our nation in the last century as regards the use of forests, grasslands, wildlife and water resources is the most violent and the most destructive of any written in the long history of civilization." More than four-fifths of our virgin timber is gone, and the annual loss still vastly

exceeds the annual growth. Our yearly loss of soil exceeds *five billion tons*. Already, in our "dust bowl" area and elsewhere, abandoned farms and dwellings uncomfortably remind us of the buried civilizations of the past.

It is easier to state the problem than to solve it. Clearly the first step is to save the forests and cease destroying the land. We must hold our remaining public lands inviolate. We must educate, we must legislate, we must preserve and restore. If we try to conquer nature, says Mr. Osborn, she will conquer us. Only through coöperation with nature can we escape disaster.

ROBERT C. MILLER
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THE NEW WORLD CYPRESSES. By Carl B. Wolf and Willis W. Wagener. *El Aliso, a Series of Papers on the Native Plants of California.* Vol. I. Rancho Santa Ana Botanic Garden, Anaheim, Calif. April 1948. xiii + 444 pp. 80 figs. Paper, $3.55. Cloth, $4.00.

El Aliso is the title of a new publication of the Rancho Santa Ana Botanic Garden, its Volume I the first of a series of future botanical and horticultural papers to be published by the Garden.

The name *El Aliso* is the Spanish-Californian for the sycamore or plane tree which is a conspicuous feature in the canyons and along the watercourses on the rancho. A magnificent specimen was a boundary mark when in 1875 Mr. John W. Bixby bought the rancho from the heirs of Bernardo Yorba. The Garden was founded in 1927 by his daughter, Susanna Bixby Bryant, in his honor, and is to be devoted to the cultivation of native Californian plants.

Dr. Philip A. Munz, Director of the Garden, will edit the series, the successive volumes to be published as botanical and horticultural articles are ready. This first, a most comprehensive work on the New World cypresses, is divided into three parts:

PART I. "Taxonomic and Distributional Studies of the New World Cypresses," by Carl B. Wolf.

PART II. "Diseases of Cypresses," by Willis W. Wagener.

PART III. "Horticultural Studies and Experiments on the New World Cypresses," by Carl B. Wolf.

In the *Geological Survey of California: Botany*, Volume II, published in 1880, only three species of cypresses were given as known in California, namely: *Cupressus macrocarpa* Hartweg, *C. Goveniana* Gordon, and *C. Macnabiana* Murr.

In Part I of this treatise which also includes the cypresses of Mexico, including Baja California, and Arizona, 15 species are described, of which 10 are Californian. Not only are all fully described but the distributional data for each are extraordinarily complete. Where species of wide distribution, such as *C. Sargentii* Jepson and *C. Macnabiana* Murr. are described, the exact location in each county of California is given from actual knowledge obtained by extensive exploration. Also, when some localities are cited from herbarium specimens, they are usually verified by exploration.

The following species of California have a limited distribution: *C. Abramsiana* Wolf, a small area in the Santa Cruz Mountains; *C. macrocarpa* Hartweg, the area bordering Monterey Bay; *C. Goveniana* Gordon, the hills above Cypress Point, Monterey; *C. Stephensonii* Wolf, the Cuyamaca Mountains, San Diego County; *C. Bakeri* Jepson and variety *Matthewsii*, Modoc and Siskiyou Counties; *C. Forbesii* Jepson, known as the Tecate cypress, on the borders of San Diego County and extending to points west of the Sierra San Pedro Martir in Baja California.

The number of synonyms of several species is due to the confusion that has arisen from the general ignorance of the genus, an ignorance which this treatise aims to correct. Burdened with the greatest number of synonyms is the Mexican species *C. lusitanica* Mill. It was described from specimens cultivated in Portugal, of unknown origin. Garden varieties often considered to be species account for some synonyms, but the fact is that a species in Mexico, known as *C. Benthamii* Endl., also variable and rich in synonyms, was later discovered to be the same, its seeds undoubtedly brought from Mexico to Portugal by early explorors.

Relationships and references follow descriptions and distributional data.

Part II treats of diseases, by which *Cupressus macrocarpa*, the Monterey cypress, seems to have been the species most seriously affected. As it has been extensively cultivated in all parts of the earth where the climate is suitable, is has been found everywhere to be susceptible to fungus diseases. Canker fungus is the most prevalent in California; but the trees near the sea seem to be relatively immune. Young plantings, too, are free, so destruction of infected trees is advocated. Distance spread of the disease is probably due to wind and birds. There are also several kinds of bark beetles and other insects that do some harm.

Part III tells of the horticultural studies and experiments on the New World cypresses. This is all derived from first hand experience in growing these plants in Rancho Santa Ana Botanic Garden. On March 10, 1927, the first lot of seeds of the Tecate cypress were planted. In the fall of 1930, the last of the then known kinds of Californian cypresses had been planted in the nursery. The work might not have been prosecuted had it not been discovered by Dr. Wagener that the canker fungus was present on trees

of the Monterey cypress. To learn of the susceptibility of other species, the work was continued and primary consideration given to observation and experimentation on plots of different kinds mixed with infected Monterey cypresses. Such plots were also established at Stanford University, at Riverside Citrus Experiment Station, and at several ranches in southern California. Besides the destruction by the canker fungus, field mice and deer ate the young plants; floods, winds, and fire added their share to endangering the success of the work, but it went on with an elaborately detailed following up of every phase of development.

The most successful species in resisting the fungus were *C. Forbesii,* the two Arizona species, *C. glabra* and *C. arizonica,* and Guadalupe cypress, native of the island of that name off the coast of Baja California.

An excellent Key to the species of the cypresses of the New World is founded on easily observed characteristics, such as the presence or absence of the glands on the back of the leaves, character of the bark, manner of growth and color of foliage. Together with the ample citations of localities, this key will greatly facilitate determination; the previous confusion concerning the identification of species should no longer prevail. There are 80 plates to illustrate apparently every feature: sterile and flowering shoots of both pistillate and staminate flowers; ripe cones and cone scales; canker fungus and diseased trees; many beautiful photographs of specimen trees of the different species, groves of cypresses in the Garden, plots of planting, etc.

The care and thoroughness that have gone into this work are impressive. The work itself is the result of eighteen years of devotion to this project, shared by Dr. Carl B. Wolf, the botanist, Mr. P. C. Everett, superintendent in charge of the Garden, and Mr. E. R. Johnson, construction engineer.

Not only will it be useful to Californians who desire to plant these cypresses as hedges, specimen trees, or wooded areas in parks or estates, but to all parts of the world with suitable climate the great mass of knowledge and experience here so well given and so ably arranged will be equally valuable. Both editor and authors are to be congratulated on the successful completion of a project unique in the combination of scientific and horticultural coöperation. Copies can be obtained from the Rancho Santa Ana Botanic Garden, R.F.D., Anaheim, California. The price listed includes postage and sales tax.

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